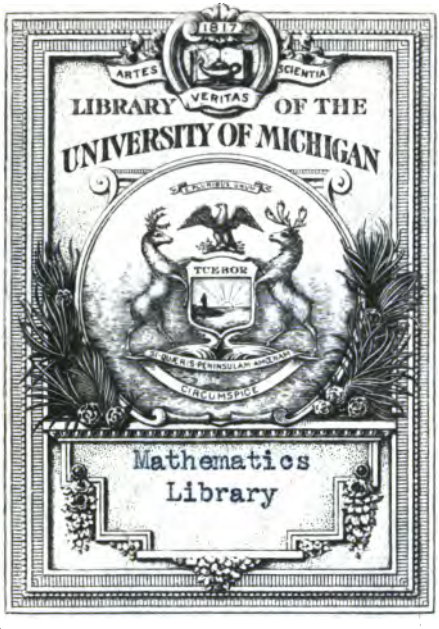
Andrew Stewart



Geo. Gillespie
2 da/26

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Author of a New System of Self-instructing Book-keeping.

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CAUTION.

THE AUTHOR, to prevent fraud, offers a reward of One Hundred Pounds to any one who will give information against any person or persons who will attempt to print or publish this work without his approbation, under his hand and seal in writing first obtained, agreeable to the Act of Parliament in that case made and provided. Also, a further reward of Fifty Pounds to any person who has taken out of this work the number of pages specified in the said Act. And a further reward of Thirty Pounds will be given to any person who will give such private information as may lead to the discovery of the offender, and his name shall be kept private.

D. O'GORMAN.

Manchester, October, 1855.

ENTERED AT STATIONERS' HALL.

The Queen's Approbation of the Work.

"Buckingham Palace.

"Miss Skerritt begs to inform Mr. O'Carman, that Her Majesty received the Arithmetic which he sent. Her Majesty thinks it is a Book likely to be of great service in teaching ready calculations.

"Her Majesty was graciously pleased to accept of the copy.

"Mr. T. O'Carman."

LITERARY NOTICES.

AMIABLE CONDUCT OF HER MAJESTY TO A RESIDENT OF THIS CITY.—"Her Majesty has been pleased to receive the book, and has, in the most handsome manner, expressed her high opinion of the merits of the work. Such a criticism, from the most illustrious personage in the realm, must go far to render the book universally sought after, and a thirteenth edition is already, we understand, in the press."—*Durham Chronicle.*

"Some short time ago Mr. O'Gorman published an Arithmetic, showing a simple and ready mode of performing various calculations. The author sent a copy of his new work as a New Year's present to the young Prince of Wales. Mr. O'Gorman received an acknowledgment from Her Majesty, which, perhaps, is the first instance on record of a testimonial being given by the most illustrious personage in the realm on the merits of a book."—*Sunderland Herald.*

"Persons now well matured in years may remember with a sigh—in the days when they were boys—

'The good old days when George the Third was King'—

the roundabout mode of calculation they were taught by their arithmetic master, and the quantity of time and paper they used to consume in noting down figures to solve a rule-of-three sum. But in the thirty or forty years that have elapsed since then everything has been going on—as Brother Jonathan would say—on the 'go-ahead' principle. Slow has been abolished for expeditious travelling—the stage-coach has given place to the railway train; the sailing vessel to the steampacket. It now seems that we are to do away with any jog-trot pace in calculations. Difficult sums which took those now 'in the sere, the yellow leaf,' a quarter of an hour to solve when they were youngsters, can now be done by their sons or grandsons in a minute or two, and instead of on a sheet of foolscap paper, on the back of a small card. Mr. O'Gorman's system brings to bear upon common arithmetic the principle of algebraic brevity. Surely never since numbers became a science was there ever such a ready and rapid method for solving questions in arithmetic, even the most difficult and the most complicated. The rules are easy, brief, and explicit, with clear examples given after each, and to render these rules comprehensible, a reason attached to each. The book is useful to young as well as to old people—to men in business, even to accountants, who, whatever methods they may have adopted by their own ingenuity to expedite and facilitate calculations, will derive benefit from a perusal of Mr. O'Gorman's book. To recommend it were supererogatory: we have only to record that it has already had nearly twenty thousand purchasers, from the highest to the lowest in the land, and that its immense popularity is well merited on account of its great and universal utility."—*Weekly Times.*

"The value of time in the counting-house, or behind the counter, needs no comment; and how much of that time is occupied by even good arithmeticians is known to every employer. A work therefore that has the effect of facilitating existing systems; but better still, of superseding them by one which gives to mental calculation the certainty of proof, is indeed an acquisition which cannot be too highly estimated. We find in this work rules which we have verified, by which six ordinary calculations are reduced to two, and frequently to one. We cannot too highly commend the volume to masters of schools, or to those young men who, entering into business, whether as employers or employed, would wish to shorten their labour at their books, and ensure accuracy beyond the reach of accident. Her Majesty has given the treatise the honour of her patronage." *Southampton Gazette.*

"This seems to us the most useful book of its kind we have ever seen. Its merits are sufficiently testified by a twelfth edition of eighteen thousand subscribers, including some of the most eminent names in the commercial world."—*Standard.*

"We would direct the attention of parties engaged in business to a valuable little publication, entitled *Intuitive Calculations*, by Mr. D. O'Gorman, who is now on a visit to this town, with a view to promote its general adoption. In these railway times, expedition has, undoubtedly, become the order of the day, and not only in our means of locomotive communication, but in the operations of trade and commerce also, the attainment of the utmost possible despatch is regarded as essential. This is the object of Mr. O'Gorman to promote, and he has done so effectually, so far as figures are concerned, for those who are disposed to consult the pages of his inexpensive little volume. He has laid down plain and simple principles, by which business calculations may be made with equal certainty, but with greater rapidity than by the prescribed rules of arithmetic. Of what, for instance, is commonly known as 'long division,' examples are given, showing the quotient in one line at the bottom, like 'short division.' No stronger recommendation, however, can be given to the work than the fact that it has reached a twelfth edition."—*Birmingham Herald.*

"Mr. O'Gorman's 'Calculations,' correctly termed, 'Intuitive,' is that which suggests itself to any man accustomed to calculations, as distinguished from conventional rules. It must have occurred to many that almost every man reckons 'in his own way,' and that way is generally any other than the one taught him at school. Mr. O'Gorman has, as it were, reduced his natural process of calculation to a system, and made a very interesting and instructive volume."—*Birmingham Journal.*

"This is one of the simplest and shortest systems of popular Arithmetic that we ever met with. To those who have the painful remembrance that we have of the labour which it costs boys to work the old rule of three problems, according to Gough or Cocker, this little volume will appear one of the *treasures of the rising generation.* Many of the rules for solving with certainty, and in an instant, the most complicated arithmetical questions, are so simple that a child may comprehend them. *The work is really a marvel of ingenuity.*"—*Hull Advertiser.*

"We have been careful to give attention to the rules laid down, and examples given after each rule, in Mr. O'Gorman's improved system of calculation; and, from the manner in which the author has treated the science of numbers, we are not at all surprised at the extended patronage he has already received. Our opinion as to its merits is, we are happy to say, corroborated by that of men of science, as well as our brethren of the press, as will appear from the testimonials appended to the work. We ought, perhaps, to add, that Mr. O'Gorman's method can be attained without the aid of a master; his book is, therefore, adapted not only to aspiring youth, but to those more advanced in life, who by its study, will effect a great saving of time and labour in all ordinary transactions."—*Newcastle Guardian.*

"Mr. O'Gorman's new work has gained a favourable critique from Her Majesty and a great portion of the local press. The system would appear to be just that which every clever man of business has suggested to him in his experience, as distinguished from the roundabout mode taught in the arithmetics in common use. The author, it will be seen, is also his own bookseller."—*Newcastle Journal.*

"Mr. O'Gorman's *Intuitive Calculations* is the most concise course ever published. We some time ago possessed ourselves of a copy of the work, an improved edition of which, the author, we believe, is about to issue. Its contents fully justify its title. It is calculated to be of great service to men of business, and, indeed, to all classes. It is a striking example of labour and ingenuity on the part of its author."—*Stockton Times.*

"In the present railway era, expedition in most things is desirable; and to a man of business, any method that will expedite calculations and simplify accounts, must be of the utmost importance. Such a method will be found in Mr. O'Gorman's *Intuitive Calculations;* and his explanations are so clear, that they will be readily understood by every person who has any knowledge of figures."—*Nottinghamshire Guardian.*

"We have pleasure in drawing attention to Mr. O'Gorman's improved method of acquiring a knowledge of arithmetic. To all persons engaged in business, a perusal of this treatise would greatly facilitate the transacting of accounts; and to young persons it may be recommended as a useful guide to a most essential branch of education."—*Preston Guardian.*

"Mr. O'Gorman's *Intuitive Calculations* is a well-written and useful work, particularly adapted to men in business, with whom training in ready calculation ought not to be neglected. An immense waste of time is incurred by a defective practice in this respect; and, indeed, than arithmetic in general, there is no science where the acquisitions of boyhood are less made use of in maturer years. Men of business habits—nay, accountants themselves—will often be found spending hours or days in multiplying and dividing, adding and subtracting—covering with figures a space as great as the wall of a house—where the use of the simplest algebraic formulæ would have solved the difficulty at an expense of three minutes of time and three square inches of writing paper. Mr. O'Gorman's work is meant, and we think succeeds, in reducing to popular practice the principles of this most important branch of education."—*Liverpool Mercury.*

"We have often wondered at the slavish adherence of people in business to the old system of doing all their calculations by what are called 'Ready Reckoners,' which are as numerous and various as the hues of the chameleon. Even these 'helps to count' do not save calculation, as, were they to meet all possible cases, their bulk would be referable to the favourite exclamation of Dominie Sampson. Any attempt, therefore, to simplify arithmetic, so as to make every man and woman their own 'Ready Reckoner' is a step in the right direction; and we have much pleasure in calling attention to Mr. O'Gorman's new system of *Intuitive Calculations*, a work which we have every reason to believe will, with very little study, supersede the antiquated system of dependence on 'Reckoners,' however 'ready' they may be supposed to be. As a manual for schools, it must be invaluable; and we believe the work has already been introduced into upwards of five hundred seminaries."—*Glasgow Constitutional.*

"In the work before us, the methods laid down are easily digested, and come within the comprehension of almost any capacity, and the rules are so clear and short, with a reason attached to each, that the mind must be dull, indeed, which cannot, after a perusal of it, transact business in the tenth part of the time usually occupied on such occasions. There is a brevity with perspicuity that enhances the value of the book, and in our opinion, it would be well if it were on the counter, and in the counting-house of every business-man in the united kingdom."—*Stirling Observer.*

INTUITIVE ARITHMETIC.—"The treatise published under this title by the author, Mr. O'Gorman, is really what the advertisement in another page asserts it to be, namely—the readiest and most concise method of calculation ever published. The rules are brief, yet perfectly explicit; and a reason being attached to each, a lasting impression is thus imparted to the youthful mind. The results, too, are given in a sixth part of the compass usually occupied by those in similar works. The system of Mr. O'Gorman is therefore not only novel but unique. In short, it may be denominated the *Royal Railroad* to arithmetic, having obtained the patronage of Her Majesty the Queen to the work, as a book likely to be of great service in teaching ready calculation."—*Caledonian Mercury.*

"How many men there are who would be deeply grateful for the ability to make their commercial calculations with facility and despatch, but who—remembering that they bestowed in their school-days many years of unrequited labour and anxiety in the endeavour—utterly despair of ever being able to gain anything like a satisfactory mastery over the science of numbers. During the adult life, treatise after treatise has been consulted with the hope that the secret of success would at length be discovered; but the search for the philosopher's stone to the man of business has been fruitless. Calculations have, therefore, continued to go on, even in the nineteenth century, at a mere jog-trot pace, and the operations are consequently regarded by many men as the most disagreeable, although amongst the most necessary, of their commercial duties. A gleam of hope, however, may yet be entertained that the science of numbers will ere long be generally considered as one of the most simple and easily acquired accomplishments of the age. Mr. O'Gorman, in the work before us, has rendered the study of arithmetic exceedingly plain and intelligible, and to those who are accustomed only to the long and tedious processes hitherto in use, the ready and

concise methods of Mr. O'Gorman will appear nothing less than marvellous. The ditty of the 'Rule of Three, that puzzles me,' will soon be looked upon as a myth of bygone days, and the name of Long Division as a misnomer. The author is now on a visit to Norfolk for the purpose of selling his work, and has given us—as he is also willing to give to others—a practical illustration of the great value of his improved system of calculation. His book has already been patronised by royalty, and by some thousands of the nobility, gentry, professors, and merchants."—*Norfolk News.*

"A twelfth edition of Mr. O'Gorman's work on *Intuitive Calculations*, making in the whole eighteen thousand copies—has just been issued of this valuable educational work. This is a great fact, incontestably proving that a publication which received the high sanction of the most illustrious personage in the realm,—Her Majesty the Queen having pronounced it 'a book likely to be of great service in teaching ready calculations'—has obtained, in an almost unexampled manner, the warm encomiums of the metropolitan and provincial press—and which has been patronized by the bankers, gentry, and merchants of the kingdom, has also found favour with the great body of the public, for whose benefit it was chiefly designed. All the rules are short, simple, and easily understood; the examples numerous and appropriate, and the whole is of a thoroughly useful and practical character, so that it may be mastered, without much difficulty, by those whose early instruction has been neglected, and may be perused with advantage to the most accomplished arithmeticians. Mr. O'Gorman deserves credit for his industry, and it is satisfactory to know that his talent is meeting with an adequate reward."—*Literary Guardian.*

"In a commercial community like this, a thoroughly practical and facile work on figures and trade calculations, cannot be too highly appreciated. A production of this character is now before the public of this country; and the opinion expressed by merchants, and many of our contemporaries, warrants a recommendation of Mr. O'Gorman's book."—*Newport Merlin.*

"Any work that will simplify the use of figures, and give facility in calculations, must be acceptable to a mercantile community, to whom time is money, and accuracy of unspeaking importance. Mr. O'Gorman appears, in the work before us, to have made a large stride in this direction, and the opinion we express is concurred in by some of the most celebrated commercial notabilities of the day."—*Star of Gwent.*

"A system of arithmetic, under the title of *Intuitive Calculations*, is now published, and has already reached its thirteenth edition. The system has been spoken of by high and competent judges, as the best ever published—both for clearness and accuracy. The work is of the greatest value to all engaged in mercantile pursuits."—*Cambrian.*

"From the few examples we have studied, we have no hesitation in saying Mr. O'Gorman's system must prove of infinite advantage in rapid calculation, and an immense waste of time will be avoided. We observe testimonials of the press from almost every part of the kingdom which Mr. O'Gorman has visited, and the fact of his work having attained a thirteenth edition of nineteen thousand copies, demonstrates that the praise bestowed upon it is not unmerited."—*The Welshman.*

"We have seen a system of arithmetic, which its author, Mr. O'Gorman, has entitled *Intuitive Calculations*. It has attained a thirteenth edition, and is accompanied with a body of commendatory notices from competent judges, who have tested the value of the work. The system appears to us to possess the double merit of clearness and conciseness; and will, doubtless, greatly facilitate arithmetical operations."—*Swansea Herald.*

"After a necessarily cursory glance at Mr. O'Gorman's work, we are enabled to state that it appears to be ingenious, and well adapted to aid persons in rapidity of calculation, by giving them concise and tolerably easy rules, which materially shorten many arithmetical processes that are usually of a lengthy character. As the object of the ingenious author is evidently a saving of time and labour, he may surely congratulate himself on having attained that result."—*Bristol Times.*

INTUITIVE CALCULATIONS.—"A work on this subject has been published by Mr. O'Gorman, a gentleman who recently visited this neighbourhood. The old system of arithmetic is metamorphosed, and the system of calculations is such, that every person engaged in business should be acquainted with it. A more valuable work for the trading community could not be published, and we cordially recommend it to them."—*Oxford Gazette.*

"We have received copies of two works from the pen of D. O'Gorman, entitled, respectively, *Intuitive Calculations*, and *A New and Comprehensive System of Self-Instructive Book-keeping*. In our case, these works have caused two very different feelings to manifest themselves. Viewing the superior facilities which Mr. O'Gorman's system afford for compassing in the shortest possible time the largest amount of arithmetical knowledge, we have given way to the regret that he did not live *some score years earlier*. We can now appreciate what an amount of laborious exercises would have been spared to the stock of our mental energies. Such were the reflections that first presented themselves; but the selfishness of the thought soon gave way to the more generous one, that the present race of learners may, if they are wise, find an easier path, and a more 'royal road' to arithmetic than we had in our younger days to traverse. We do not now speak of Mr. O'Gorman's treatises as those just ushered into light, although not until lately has our attention been drawn to them; still they have been for some time before a large portion of the public. Mr. O'Gorman being one of those who think that business is never as well performed by a deputy as it is by the principal himself in person, he has but recently visited Sheffield. 'Every author his own bookseller' is strikingly exemplified in the present case. As far as Mr. O'Gorman has published himself, the highest praise has been bestowed on the merits of his treatises: the Arithmetic has already reached a thirteenth edition, and although late, still we are glad—even now—to add our testimony to the value of his labours." *Sheffield Free Press.*

"Being anxious at all times to forward works of a useful character, we have great pleasure in recommending to our readers, O'Gorman's new *Intuitive Calculations*, believing as we do, that the work is one of the most valuable acquisitions that has yet been produced in reference to the branch of education on which it treats. Mr. O'Gorman has succeeded in simplifying arithmetic, so as to render it easy of acquisition by the humblest

capacity, without the aid of a teacher. Abbreviating the process of education is one of the advantages which may be calculated upon in these days of improvement. There are few who have passed their pupilage who will not have felt they have been led through a long and intricate path. Their grammar and spelling-books were dry and tedious productions; so were their arithmetics. Each has undergone various simplifications, and the young student has had a view of the thorns cleared from his track which, however, in some important branches of education is yet beset with many difficulties. We are glad that another successful experiment has been made by the author of the above work, whose system has drawn forth the highest encomiums from preceptors of undoubted respectability. The work has passed through twelve editions, and about eighteen thousand copies have already been circulated."—*Huddersfield Examiner.*

"We have long desired to see a work which would facilitate the operation of figures. Such a work is before us. Not only does Mr. O'Gorman reduce his demonstrations to the smallest number of figures, but he gives a 'why and a wherefore,' which will enable the student to follow the necessary calculations, and to arrive by a shorter and more conclusive method than before, at the desired 'quotient.' The importance of a good system of arithmetic to a commercial community cannot be overrated. The work has been submitted to Her Majesty, who was graciously pleased to approve the same. It has, however, received a more practical mark of approbation by the sale of twelve editions, or 18,000 copies."—*Bath Journal.*

"Mr. O'Gorman has produced a book which was most decidedly wanted. Instead of merely reiterating the formal and tedious rules usually contained in works on arithmetic, he exhibits the brief, easy, and rational process by which persons versed in calculation attain the same results, and moreover (a very striking peculiarity) gives *reasons* for these processes. The work is patronised by no less a personage than her most Gracious Majesty; and it appears that 18,000 copies have already been disposed of to bankers and tradesmen, merchants, accountants, surveyors, clerks, professors and teachers, to all of which classes it must prove eminently useful."—*Lynn Advertiser.*

O'GORMAN'S INTUITIVE CALCULATIONS.—"In an essentially commercial age like the present, good arithmetical works are desiderate. This want has been in some measure supplied by Mr. D. O'Gorman, who has compiled a series of *Intuitive Calculations*, the usefulness of which has been already highly appreciated by 18,000 subscribers, and, therefore, ought to meet with the patronage of the commercial public generally."—*Lynn Independent.*

"Many systems of arithmetic as we have seen, this surpasses all. Mr. O'Gorman seems to have arranged his book on the unerring principles of true philosophy, and therefore, so far, has followed the laws of nature. He seems to us to know the exact workings of men's minds, when engaged in calculation, and has arranged his rules accordingly. Nothing is more easy to the beginner than this system of arithmetic, than which, nothing has yet met our attention worthy to be compared with it. We shall highly prize it as a book for every-day reference. If every school has not adopted it, the sooner it is called into requisition the better it will be for the rising generation."—*Lincolnshire Free Press.*

"We have been shown a book containing an exposition of a new and concise method of arithmetic, which appears, at a cursory glance, to present great advantages over the system now in use. The author of the work is Mr. O'Gorman; and, as a proof of its popularity, we may state that it has reached the thirteenth edition, and that as many as 18,000 copies have been sold. By the study of this work the old-fashioned and complex system of arithmetic may be entirely discarded, and a much more simple one substituted in its stead."—*Essex Gazette.*

O'GORMAN'S INTUITIVE CALCULATIONS.—"For the superior character of this volume, it will suffice to point to the fact of its having been introduced into upwards of 500 schools, and to state that it has already reached its thirteenth edition. To all to whom the saving of time and labour is an object—instructors, pupils, merchants, shopkeepers, &c.—the work must be invaluable."—*Dover Telegraph.*

"Mr. O'Gorman's work will be found of the greatest use in facilitating mental calculations, as well as making the student familiar with the ordinary arithmetical processes. The copious tables of coins and exchange, and for the reduction of weights and measures, add greatly to the value of the treatise. We do not wonder that this little work, which has attracted the commendation of royalty, should have, as we are glad to learn that it has, become extensively popular."—*Northern Whig.*

INTUITIVE CALCULATIONS.—"In a little work thus entitled, Mr. O'Gorman—formerly our fellow-townsman—has supplied what we regard as an educational and mercantile *desideratum.* We commend it as an admirable epitome of concise arithmetic, serviceable both in the school-room and the counting-house; adapted, by the clearness and simplicity of its rules, to quicken and improve the mental powers of youth, and, in the infinite diversity of its devices for expediting calculations, suggestive of resources to the most accomplished arithmetician."—*Newry Telegraph.*

"The process of Arithmetic, formerly so tedious and complicated, has been wondrously simplified within the last half century; and the *Intuitive Calculations* of Mr. D. O'Gorman adapt the various improvements in so happy a manner that, when combined wtth the additions which may claim originality, there appears truth in the Author's representation—that it is 'the readiest and most concise method ever published.' It is certainly very concise and ready, and he has cause to be proud of the little work. Arithmetical results are obtained by it with almost algebraic quickness. The manual is a very useful one."—*Sharpe's London Magazine.*

TESTIMONIALS.

Royal Mint, London, 28th June, 1855.

DEAR SIR,—I have read with great pleasure your last edition on calculations, the easiest and the best I have ever met with. I have shown it to my friends, engineers, and moneyers, who are all unanimous in pronouncing it the most useful book they have ever seen.

Mr. D. O'Gorman, Manchester. WILLIAM BUCKLE,
Royal Engineer.

Nautical Almanac Office, 3, Verulam Buildings,
Gray's Inn, July 15th, 1855.

DEAR SIR,—Accept my thanks for the copy of the twelfth edition of your *Intuitive Calculations* you were kind enough to send me. It is certainly a departure, in the right direction, from everything of the kind which has preceded it. The whole book bears indelibly the stamp of originality, and its usefulness in the ordinary business matters of life is strikingly apparent. The rules are written in a clear and pleasing manner, which, with the various notes, are exceedingly well calculated to create that feeling of interest so essential to the acquisition of any kind of knowledge. Large as has been the sale of the work up to the present time, it falls short of what its merits deserve.

I am, dear Sir, faithfully yours,

RICHARD FARLEY, F.R.A.S.
Chief Calculator in the Nautical Almanac Office, London.

Mr. D. O'Gorman, Manchester.

Cambridge Observatory.

DEAR SIR,—I have carefully examined the twelfth edition of your *Intuitive Calculations*, and have great pleasure in bearing testimony to the ingenuity of your rules, which produce such brevity in operation. You have arranged a system that must render great and important service to the mercantile community, as well as to the rising generation, notwithstanding that many have grappled with the subject of which you treat. Some brought out works obscurely written; whilst others were found more cumbrous than even the common routine; but the ease with which you arrive at conclusions, and the concise and clearly-developed rules, as well as the simplicity of your methods, belong to a different order, and must be

incalculably invaluable in the various mercantile pursuits in life. No branch of mercantile calculations appear to be overlooked in your treatise, and the brevity with which you calculate the most minute fraction, at once show that you were fully competent for the work you had undertaken. Indeed, I do not wonder at the numerous list of subscribers that fill your pages; and, I have no doubt, the more your book is known, the more will the public appreciate the services you have rendered to the busy part of mankind. Wishing you every success,

I am, Sir, respectfully yours,

Mr. Daniel O'Gorman. JAMES BREEN.

Sir,—The Committee of the Manchester Free Library and Museum have received your book on *Intuitive Calculations*, and request me to return you their best acknowledgments and thanks.

I have the honour to be, Sir,

Your most obedient Servant,

JOHN POTTER,

Mr. D. O'Gorman. Chairman.

Glasgow Athenæum.

Dear Sir,—I have carefully examined your work on concise calculation, and have no hesitation in bearing my humble testimony that it is incomparably the easiest understood, and by far the most complete of any work hitherto published on the subject. I am sure it only requires to be known to be placed in every office and counting-house in the United Kingdom: it is also adapted for a *class-book* in every public and private school, as its simplicity renders it of incalculable value to the student. In the hands of fathers and mothers, their children can progress with ease and facility in the solution of numerical calculations, by its plain and unerring guidance. I shall merely repeat that your little book is the most complete, important, easy, and useful work that has ever issued from the press on the subject of concise arithmetic.

Wishing you a long life to exercise your genius and talents for the benefit of mankind, I remain, dear Sir, faithfully yours,

JAMES McKENNA,

Vice-Chairman of the Board of Directors of the Glasgow Athenæum.

Mr. D. O'Gorman.

Charlotte Square, Newcastle-upon-Tyne.

I have carefully looked through Mr. O'Gorman's admirable little treatise on arithmetic. Its tables are of the most useful description. Its rules are given with clearness and precision, and constitute it the very best manual I have seen of rapid and expeditious calculations. Portions of it show that Mr. O'Gorman has sounded the depths of the profoundest parts of Arith-

metical science. I have been delighted with his book, and sincerely hope that its sale will be in exact proportion to its utility; and then, if the author be not remunerated sufficiently for the usefulness and clearness of his labours, there is no truth in the most golden rule of the important science, to the elucidation of which he has directed his talents.

Mr. Daniel O'Gorman. CHARLES LARKIN, M.D.

Academy, 2, Hedworth Terrace, Sunderland.

DEAR SIR,—I have examined your *Intuitive Calculations*, and consider it well calculated to prepare youth for the engagements of business. Your rules are concise, and adapted to illustrate the multifarious application of figures, and must greatly conduce to the discipline and expansion of the youthful mind. Your exercises are in accordance with real business transactions, which is very important to the noviciate, and you have avoided all circuitous calculations, and have adopted methods, which involve an originality (and in no case inapplicable) to which you, as an author, can with justice lay claim.

I am, dear Sir, yours very respectfully,

JOHN MARTINDALE,

Mr. D. O'Gorman. Author on Agricultural Chemistry.

Lancashire and Yorkshire Railway,
General Manager's Office, Manchester.

DEAR SIR,—I duly received a copy of your new *Intuitive Calculations*, and I can assure you, the methods adopted therein are far beyond what I expected. A good knowledge of the tables, I find, is all that is required to glide easily into the midst of calculations, which, except by your ingenious invention, would be most tedious and cumbersome. I am very much interested in your book, and glad to find you have such extended patronage among railway managers and clerks. Your rules for calculating the carriage of goods and clearance house, must be invaluable in that department, the adoption of which will greatly lighten the drudgery subject thereto; and the sooner your system is adopted in such places the better. In fact I find nothing omitted in general use for the business man.

I have only to add that I wish you success, and glad to find you are gone to press with a new edition.

I am, dear Sir,

Very truly yours,

Mr. D. O'Gorman. M. F. FENNELLY.

ADVICE TO YOUNG MEN.

"Good rules acted upon are the sinews of character."

My dear Friends,—Read, mark, and digest the following lines: they were written for the benefit of young men, and it is hoped many will profit by them.

First.—Observe strict integrity in all your conduct. Never make a promise which you have not a reasonable prospect of fulfilling; and, when once made, use every exertion in your power to accomplish it. To be successful in the performance of your duties, *first learn to do everything well, then learn to do it in the least possible time;* by continued and persevering efforts, both will become easy and habitual to you, and the habits thus formed will be of incalculable benefit through life. Make it a matter of principle to discharge all the duties assigned you to the best of your ability; endeavour to do more than is expected of you, rather than less, for by so doing, you will not fail to acquire the confidence and respect of your employer. If you find that you cannot accomplish all that he may require of you, notify him thereof in season, that his expectations in regard to you may not be disappointed, nor his business unnecessarily retarded, and your own credit will thereby be saved.

Second.—As we become attached to those who take pleasure in our business, and in promoting our interest, it may be received as a maxim, that the more you are doing for your employer, the more you are doing for yourself; as by that means you are perfecting your own usefulness, and increasing his favourable opinion of you, to deserve which, should be your constant aim, and which will, in after life, be to you a source of much credit and satisfaction, and often of very great advantage.

Third.—At all times show proper respect to your employers and superiors in station, and take pleasure in obliging them. Keep the secrets of your employers *inviolate;* relate none of his business to *his* or *your* most intimate friends; it would be

manifest treason on your part to do so; besides, too, it is as much his property as the money in his drawer. Your time is the property of your employer; do not, therefore, absent yourself during the hours of business without his permission.

Fourth.—Never permit others to injure your employer, or abuse his confidence, without giving him notice, for your own character is concerned in it as well. When sent an errand, or requested to attend to any special duty, use *despatch*, and make a report immediately on the performance thereof; as it frequently happens that matters of importance are connected therewith, which may require immediate attention.

Fifth.—Let the duties of each day be regularly performed, even if extraordinary effort be necessary. Do everything in its proper season, and postpone nothing which you can conveniently attend to. Undertake but *one* thing at a time, and pursue it, if possible, till accomplished. Let there be a distinct and separate place for everything, and keep everything in its place.

Sixth.—Keep an account of your expenses, and economise your money as well as your time: your future happiness and respectability will depend, in a great measure, on the proper use of both. The celebrated Duke de Sully, the great French statesman, ascribed his success in life to the strict economy observed in his youth. Should you meet with difficulty in the performance of your duties, do not be discouraged on that account, for you will overcome them all by perseverance. A sound and discriminating judgment is particularly necessary in buying and selling. As the skill of a physician consists in ascertaining the precise nature of a disorder from the symptoms it presents, and as this skill cannot be acquired without diligent and extensive observation, in like manner the cleverness of a tradesman chiefly consists in being able keenly and correctly to perceive the value of the article in which he traffics; nor can this acuteness be obtained without vigilant attention, or, in other words, without considerable mental exertion.

Seventh.—The careful observance of those rules will enable you to get through with your duties, not only to the satisfaction of your employer, but even to your own advantage; and if you are careful to observe them conscientiously in the several respects in which they are laid down, you may reasonably expect the blessing of Providence will rest upon you, and you will not fail to reap your reward in due season.

Eighth.—To those young men who are entering as mechanics,

we would say, let it be your strong and abiding determination to become master of your art or calling, whatever it may be. Study it deeply, and in all its branches. Resolve to be ignorant of nothing that pertains to it. Strive to acquire despatch with cleverness in performing all its duties, from the most trivial to the most momentous. This habit you will not fail to acquire, if you make it a rule to do everything in the best and quickest way you possibly can. Many a bungling, good-for-nothing workman, has become such, not for want of capability, but for want of desire to excel, which has led him to contract the habit of doing everything in a careless, slovenly manner. Be not satisfied with learning your business by rote, and of attaining that manual dexterity which careful practice will ensure; but endeavour to form comprehensive views of the nature of your profession. Examine and become familiar with the scientific principles on which it is founded. This will teach you the best method of conducting the operative part of it; it will enable you to account for strange appearances, and to deal with new cases, of which, if you are ignorant, would be inexplicable and embarrassing. And there is scarcely any department of manual occupation, however mean, which does not involve philosophical principles, the knowledge of which it is, therefore, the interest of all workmen to obtain.

THE AUTHOR.

Manchester, 1856.

ADVERTISEMENT.

THE extensive sale, and still pressing demand, for the new *Intuitive Calculations*, obliges the author to meet the anxious wishes of the numerous public who have so liberally patronised him in the sale of the fourteen former editions, and therefore he requires little apology in introducing a fifteenth.

To the present edition many useful rules are added, and new discoveries made in the application of figures, which the Philomath, the man of genius, and the mercantile man, will find well calculated to assist him in transacting the ordinary business of the day with accuracy and despatch, and in the tenth part of the time usually required or laid down in the common school arithmetics, and all so plain and intelligible, that the plan of operation is brought under the comprehension of the weakest capacity, and if not convenient, the system can be acquired in ten or twelve weeks without the aid of a master. Neither pains nor expense has been spared in rendering the present edition of the greatest importance to the merchant, the mechanic, the accountant, and the tyro, who wish to become smart and ready calculators, no matter how difficult the transaction, and all with such facility and precision as to ensure a correct result. All that is required is a perfect knowledge of the tables to put the plan in operation; and should an error be committed, the system is so brief, that it will at once be discovered, and an easy correction made, without poring over a side of figures, usual in the ordinary method of calculation.

It is acknowledged by all, that young men after six or seven, nay, some ten years' studying arithmetic at school, and then entering into business, must throw aside the old school course, and take the readiest method that ingenuity can devise for totting their accounts; yet such is the fact. To remedy this want, and to give a proper system of concise calculation to the public, is the great object and aim of the author, and it is now gratifying to him to have such a list of subscribers to bear testimony to the usefulness of past labours.

To the nobility, gentry, professors, teachers, merchants, and traders, he tenders his warmest thanks and acknowledgment for their liberal support; and the sincere wish of his heart is, that each and every one into whose hands the present edition may fall, will reap the benefit intended by him.

As the tables are of the greatest importance, and in fact may be called the buttress of all calculations, we would beg the most serious attention of our young friends to study them with accuracy, and not only that, but to commit them to memory, and to observe the general rule laid down by a judicious author, "*that anything well known should not be too long dwelt upon, nor anything imperfectly known passed over.*" The simple and compound rules, with their variations, being well understood, the calculations after become simple, and all mercantile transactions rendered familiar, the principle being based on two numbers, 12 and 240; 12 pence being a shilling, and 240 pence a pound, these two numbers are, of course, applied in all cases, according to our present computation; 12 being brought up to 240 by an equation, with the smallest fraction, and 240 to infinity in a similar manner. A perfect knowledge of the money tables, together with these new composite tables of 12 and 240, with their fractions, are essentially necessary in our present system; but as the decimal system of computation may, at no distant period, be brought into operation, the author has appended the primary rules of that system, together with the decimal coins, with new tables, showing the integral quantity in decimals, in money, weights, and measures, which will enable the accountant or mechanic to arrive at results in a moment, and has given as much as is necessary to prepare the public mind for the great and important change contemplated by the wisdom of parliament; and as the pound sterling will remain the integer, all that will be required to know is the denominations of the lesser coins, which will be florins, cents, and mils; and that ten mils make a cent, ten cents a florin, and ten florins a pound, which, with their component parts of the integer, will be treated in their proper places.

In conclusion, the author submits the present edition, confident of a renewal of that liberal support which he has hitherto received from an enlightened public.

D. O'GORMAN.

Manchester, 1856.

INTRODUCTION.

As the common arithmetics of the day contain much matter with which there is no absolute necessity that every pupil should make himself acquainted; and as these books generally fall into the hands of those who have no time to waste in attaining ready calculations, this work, indiscriminately, is intended to assist them in the accomplishment of so desirable an object. We have, therefore, carefully studied what course should be laid down in a matter of such importance, and we trust the rules and examples will be found to suit the object in view, viz.,—the rapid improvement and easy access of the pupil to ready calculation. We venture to assert, that, in the following treatise, such a system of science and practice will be found, as to convince our readers they never met with anything more suitable to their avocations and wants. We purpose to lay down such rules, principles, and systems, that every schoolboy, and those of the most dull apprehensions, will receive such benefit and instruction as no other work on the subject can afford. After our young friend has made himself master of numeration and its dependent principles, we then recommend to his most serious perusal, the definitions and tables in the first part of the work: these, if properly attended to, will serve him in the whole course of his studies. Many excellent accountants have been wandering in the dark, merely through want of such assistance. If the pupil's time and genius afford the opportunity of committing to memory our demonstrations, so much the more will he profit; but if these favourable circumstances occur not, then let him carefully attend to the tables; and we assert, roundly, so complete a set of tables of coins, weights, and measures, were never before published; a perfect knowledge of which will serve every student, be his intended profession what it may. In the whole, the system will be found of the greatest importance, and the pupil, therefore,

according to his ability and taste, should attend to it closely, and make it his study never to pass over any rule without knowing its meaning, nor dwell too long on any case perfectly understood.

Surely, short and easy methods in accounts give the pre-eminence; and, indisputably, this system contains more thereof than any other before published. The simple rules are laid down in a manner not hitherto given by any author; and what is commonly called *Long Division*—a rule occupying so much time and difficulty to the learner, and trouble to the teacher—is illustrated by examples, showing the quotient in one line at the bottom, like *Short Division;* thus saving much time and labour to master and scholar. In the compound rules will also be found many useful hints and methods, entirely suited to the business of the day, and well worthy of perusal; and these methods, when fully understood by the pupil, will qualify him to pass through the general routine of business with that adroitness and facility with which every one aspiring to become a good accountant should make himself acquainted.

From these general observations on the work, we apprehend our readers will be better qualified to go through the system than if left entirely to their own judgment. True, indeed, the work speaks for itself; but still we think there is an absolute necessity in pointing out the improvements and orignality in which our system exceeds others, in directing the attention more fully to those advantages so necessary both in theory and practice.

We hope that the judicious teacher, who has his pupil's interest at heart, will carefully direct him to study these short rules and methods with the most ardent attention, and that neither prejudice nor long contracted habits will prevent him from at once introducing a system that will be creditable to himself and beneficial to the youth committed to his care, which he must see, will assist the pupil in his ordinary concerns in after life, and give him a taste in the meantime for proficiency in numbers, which nothing but such brevity of operation could produce.

Teachers will find this work of the greatest importance to themselves and scholars. The number of examples suited to all ranks and professions, with the shortest methods possible of solution, and the whole deduced from rational principles, will leave nothing wanting for their use and information.

Foreign exchanges by the chain rule are copiously given

at the end of the work, which will be found of great utility to merchants and traders who reside in seaport towns, and who transact business with foreign nations. The appendix on decimals, with the new tables, showing the integral quantity in decimals, money, weights, and measures, will also be found interesting. No business man ought to be without a knowledge of computing by this useful and expeditious method; and it is to be hoped many will avail themselves of the system we lay down. In fact, neither labour nor expense has been spared to render the work worthy of the highest patronage royalty could bestow, with which it was honoured on its first appearance; nor has anything been omitted to promote the accession of the present edition into every counting-house, office, and school in the united kingdom. The author, therefore, presumes on the continued support of an enlightened public; and if nothing accrue but the diffusion of his plan of ready calculations throughout the rising generation, he rests quite satisfied his readers will benefit by it, and he will have attained his object.

THE AUTHOR.

Manchester, 1856.

INTUITIVE CALCULATIONS.

DEFINITIONS.

1.—Calculation is a method which teaches how to apply the relation of numbers one to another, and by them deduce precepts of computation relative to the affairs of the busy part of mankind. And, in reality, there are but two primary operations, from which the rest are all branches, viz.,—Addition and Subtraction, as will be clearly demonstrated. Multiplication is but a contracted method of Addition, and Division a contracted mode of Subtraction.

2.—The most part of the objects of our knowledge may be said as being capable of augmentation and diminution; and our ideas of things, as far as they have that tendency, are what we call quantity, by which word may be comprehended whatever can be properly said to have parts. Under this definition we may class extension, weight, motion, time, &c. The one being taken, greater or less, heavier or lighter, swifter or slower, in proportion to one another of the same kind; and, since the primary property of quantity is the being capable of more or less, quantities may be added to, subtracted from, or multiplied by one another, and consequently divided into the parts they contain.

3.—Uuity is a quantity, which is determined in order to be represented, or to be divided into parts: in the first case it is called integral, in the second, fractional: as a bushel of oats, or 6 bushels &c.; a $\frac{1}{4}$ of a bushel; an $\frac{1}{8}$, &c. Here the two integrals are separated by 1 and 6, and the two fractions by $\frac{1}{4}$ and $\frac{1}{8}$.

4.—Number is many composed of units.

5.—A number is said to measure another, when the lesser being taken a number of times, is exactly equal to the greater, as 8 measureth 24, because 3 times 8 make 24. Unity measureth all numbers.

6.—One number is a multiple of another, when the less measureth the greater, or when the greater containeth the less a number of times exactly.

7.—An aliquot part of a number is that which measureth the said number without a remainder. The number 2 is an aliquot

part of 10, being taken 5 times; but 3 is an aliquant part of 10, because it does not measure 10 without a remainder. Therefore any number that measures another number without a remainder, is called an aliquot number; and any number that does not exactly measure another number, is called an aliquant number.

8.—Numbers consist of digits, articles, compounds, whole, broken, mixed, &c.

9.—Numbers are equal, unequal, even, odd, evenly even, evenly odd, oddly odd, composite, plain, solid, perfect, harmonic, square, cube, &c., &c.

10.—Equal numbers are such as contain an equal number of units.

11.—Unequal numbers are those whose number of units differ.

12.—An even number is that which may be divided into two equal parts.

13.—An odd number is that which cannot be divided into two equal parts.

14.—A number evenly even, is that which an even number measureth by an even number: such is 24, which is the even number 6 measured by the even number 4.

15.—A number evenly odd, is that which an even number measureth by an odd number: such is 12, when the even number 4 measures by the odd number 3.

16.—A number oddly odd, is that which an odd number measureth by an odd number: such is 21, which an odd number 7 measureth by an odd number 3.

17.—A composite number is that which some certain number besides an unit measureth, and consequently hath several aliquot parts: such as 4, 6, 8, 10, 12, 14, 16, and infinite others.

18.—Plain numbers are such as are made of the multiplication of two, as 6×2 are 12.

19.—A solid number is that which is produced from the multiplication of three numbers; and the numbers that multiply one another are called the sides of the solid number; consequently every solid number is composite. 24 is a solid number, because it is made by the multiplication of three numbers, 2, 3, and 4; for $2 \times 3 = 6$, and $6 \times 4 = 24$.

20.—Perfect numbers are such, whose aliquot parts added together are equal* to themselves: as 6, whose parts are 3,

* If a series of numbers continually proportionate from unity in a duplicate ratio be continued until their sum be a prime number, the sum being multiplied into the greatest term, shall produce a perfect number. Hence,

2, 1=6. The second perfect number is 28; for all the aliquot parts thereof are 1, 2, 4, 7, 14, which added together make 28.

21.—Harmonic numbers are such, that the aliquot parts of the one collected are equal to those of the other.

22.—A square number is that which is made by the multiplication of two equal numbers; or by the multiplication of any number by itself, which is called a square root. The first square in whole numbers is 4, which is made by multiplying 2 into itself; the second is 9, which is found by 3×3 and so on to infinity.

23.—A cube number is that which is made by the multiplication of three equal numbers; the number itself is called a cube root. The first cube except 1 is 8, which is found by the multiplication of 2 thrice taken: $2\times2=4$ and $4\times2=8$. The second is 27, which is made by the multiplication of 3 taken thrice, as $3\times3=9$ and $9\times3=27$.

24.—In numbers, the ratio or proportion is the mutual habitude of two numbers to one another, and is twofold, either in respect of quantity or quality. In respect of quantity, it is considered between two numbers; the first called the antecedent, the second the consequent, and is equal, as 3 to 3, or unequal, as the greater to the less, 6 to 4, or the less to the greater, 4 to 6.

In respect of quantity, which produce a similitude of reasons called proportion, it is considered between more than two numbers; for though the reason of two numbers may be had as before, yet a similitude of reasons cannot be found, unless the numbers be more than two, and is threefold. First, in respect of their difference; second, of their quote; third, in respect of both.

Of the first, ariseth Arithmetical proportion; of the second, Geometrical proportion; of the third, Harmonical proportion.

A Theorem is a proposition whose truth is to be demonstrated.

A Problem is a proposition of something to be done or discovered.

A Lemma is a Theorem, instructive to some subsequent proposition, to shorten the proof or practice of it.

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by the above, may be found all the perfect numbers; because the sums of 1 and 2 are 3, a prime number, $3\times2=6$, the first perfect number, whose aliquot parts are 1, 2, and 3; and because the sums of 1, 2, and 4, are 7, a prime number, 7 multiplied by the greatest aliquot part 4, make 28, the second perfect number, whose aliquot parts are 1, 2, 7, and 14. Again, the sums of 1, 2, 4, 8, and 16, are 31, a prime number $=31\times16=496$, the third perfect number. The aliquot part of the next are 1, 2, 4, 8, 16, 31, 62, 124, 248.

A Corollary is a proposition gained by one whose truth is evident from the truth or demonstration of another.

A Demonstration is an infallible proof of the truth or falsity of propositions.

AXIOMS.

1.—Those things which are equal to the same thing are equal to one another.

2.—If equals be added to equals, the whole shall be equal.

3.—If equals be taken from equals, the remainder will be equal.

4.—If equals be multiplied by equals, the product shall be equal.

5.—The whole is equal to all its parts.

A Postulate is something granted on which to found a proof.

An Axiom is a proposition whose truth is self-evident.

A Proposition is whatever is affixed or proposed, either as matter of assent, practice, or speculation.

Propositions are divided into Theorems, Problems, Lemmas, and Corollaries.

Numeration is the first principal part of Computation, and teaches how to read, write, value, or express any number of figures, and consists of two parts.

1.—The due order of setting down figures.

2.—The value of each figure in its proper place.

NOTATION AND NUMERATION TABLES

are the first parts of Arithmetic, and shows how to note down, enumerate, and read the value of numbers.

PLACE														
1st.—Units*	...	...	...	...	...	...	1	1	1	1	1	1	1	Units.
2nd.—Tens	...	...	...	...	...	...	2	2	2	2	2	2	2	
3rd.—Hundreds	...	...	...	...	...	...	...	3	3	3	3	3	3	
4th.—Thousands	...	...	...	...	...	...	...	...	4	4	4	4	4	
5th.—Tens of Thousands	...	...	...	...	...	...	...	...	...	5	5	5	5	
6th.—Hundreds of Thousands	...	...	...	...	...	...	...	...	...	...	6	6	6	
7th.—Millions	...	...	...	...	...	...	...	...	...	...	...	7	...	Millions.
8th.—Tens of Millions	...	...	...	...	...	...	...	...	...	...	...	8	...	
9th.—Hundreds of Millions	...	...	...	...	...	...	...	...	...	...	...	9	...	
10th.—Thousands of Millions	...	...	...	...	...	...	...	...	...	...	...	1	...	
11th.—Tens of Thousands of Millions	...	...	...	...	...	...	...	...	...	...	...	2	...	
12th.—Hundreds of Thousands of Millions	...	...	...	...	...	...	...	...	...	...	...	3	...	

* The first period is called Units, the second Millions, the third Billions, the fourth Trillions, the fifth Quadrillions, &c., and so on to Quintillions, Sextillions, Septillions, Octillions, &c.; and when the pupil can read one period well, he may read any length of figures whatever.

13th.—Billions, or Millions of Millions...	4	Billions.
14th.—Tens of Billions	5	
15th.—Hundreds of Billions	6	
16th.—Thousands of Billions	7	
17th.—Tens of Thousands of Billions	8	
18th.—Hundreds of Thousands of Billions	9	
19th.—Trillions...	1	Trillions.
20th.—Tens of Trillions	2	
21st.—Hundreds of Trillions	3	
22nd.—Thousands of Trillions	4	
23rd.—Tens of Thousands of Trillions	5	
24th.—Hundreds of Thousands of Trillions	6	
25th.—Quadrillions	7	

NOTATION BY LETTERS.

I. ... ... One	XII. ... ... Twelve	L. Fifty
II. ... ... Two	XIII. ... Thirteen	C. One Hundred
III. ... ... Three	XIV. ... Fourteen	D. Five Hundred
IV.... ... ... Four	XV. ... ... Fifteen	DC Six Hundred
V. ... ... Five	XVI. ... Sixteen	M. One Thousand
VI.... ... ... Six	XVII. ... Seventeen	$\overline{V}$. Five Thousand
VII. ... ... Seven	XVIII. ... Eighteen	$\overline{X}$. Ten Thousand
VIII. ... ... Eight	XIX.... ... Nineteen	$\overline{L}$. Fifty Thousand
IX.... ... ... Nine	XX. ... ... Twenty	$\overline{C}$. One Hundred Th.
X. ... ... Ten	XXX. ... Thirty	$\overline{D}$. Five Hundred Th.
XI.... ... ... Eleven	XL. ... ... Forty	$\overline{M}$. One Million

ADDITION.

ADDITION of whole numbers is the second essential point of computation, and teaches of several numbers of the same denomination to make one total, called their sum.

RULE.—Set down all the numbers to be added, write no figure in the same column that is not of the same value or place, then draw a line under them.

2.—Begin at units place, add up that column, and find how many tens are contained therein.

3.—Set down what remains above the tens, or, if nothing remain, write down a cipher, and carry* as many ones to the next column as there were tens in this.

4.—Proceed with the second column in like manner, and so on till all be finished.

* *Reason for carrying one for every ten.*—Because ten units in the first column towards the right hand make an unit in the next row towards the left; therefore the reason for carrying one for every ten is evident; and the method of placing the figures is no less true, because any other arrangement of them would alter their value. This rule is founded on the known axiom "the whole is equal to all its parts." (Axiom 5.)

EXAMPLES.

1.—3 5 4 7 8 6 7		2.—4 8 5 4 7 6 3	
5 4 6 6 4 3 2		5 6 8 6 5 4 2	
4 6 7 4 8 3 4		6 5 7 6 4 8 3	
6 7 5 2 3 4 2		2 3 4 2 8 6 5	
4 8 3 7 6 5 6		3 7 9 8 7 5 2	
2 5 2 7 9 1 3 1	Sum.	2 3 2 5 9 4 0 5	Sum.
2 1 7 3 1 2 6 4		1 8 4 0 4 6 4 2	
2 5 2 7 9 1 3 1	Proof.	2 3 2 5 9 4 0 5	Proof.*
3.—4 7 6 8 3 4 8		4.—5 8 7 6 4 3 9	
7 3 5 8 6 3 4		8 3 6 7 6 4 3	
6 7 8 5 4 7 3		9 8 7 6 4 7 6	
8 6 4 2 3 4 7		5 7 6 3 7 6 4	
5 3 6 4 8 2 4		9 8 7 6 3 7 8	
3 7 8 6 4 3 6		6 4 6 3 7 6 4	
8 6 7 5 3 8 7		5 3 7 6 4 7 8	
7 5 3 7 6 4 2		8 2 3 7 6 4 2	
8 9 7 6 4 3 2		3 7 8 6 4 2 3	
6 1 8 9 5 5 2 3	Sum.	6 3 6 2 5 0 0 7	Sum.

A NEW AND EXPEDITIOUS METHOD FOR TEACHERS IN LARGE SCHOOLS.

In putting down the question, arrange it so that every two figures in units place make ten, and every two figures after to the left, nine. The key line may be put at top, bottom, or middle of the question; which line will be the sum required.

EXAMPLES.

5.—5 4 7 6 5 3 8		6.—6 7 8 6 4 7 5	
4 5 2 3 4 6 2		3 2 1 3 5 2 5	
3 7 5 4 6 3 4		5 3 7 8 6 5 4	
6 2 4 5 3 6 6		4 6 2 1 3 4 6	
5 8 6 4 7 8 3		6 8 3 4 2 7 8	K. L
4 1 3 5 2 1 7		5 7 6 3 4 2 1	
3 4 8 3 7 6 2		4 2 3 6 5 7 9	
6 5 1 6 2 3 8		3 4 2 3 4 5 6	
2 1 2 3 4 4 6	K. L.	6 5 7 6 5 4 4	
4 2 1 2 3 4 4 6	Sum.	4 6 8 3 4 2 7 8	Sum.

* *First Method Proof.*—Draw a line at top, and suppose the head line cut off; add all the rest together, and set their sum under the number to be proved; add the last line to the upper one, and if the sum be the same as that found by the first addition, the work is right. *Second Method.*—Key line proves itself.

7.—								
	4	1	2	5	6	3	4	K. L.
	5	7	8	6	5	4	3	
	4	2	1	3	4	5	7	
	6	3	4	5	2	4	1	
	3	6	5	4	7	5	9	
	4	7	8	6	5	4	2	
	5	2	1	3	4	5	8	
	6	3	7	8	6	4	5	
	3	6	2	1	3	5	5	
	4	4	1	2	5	6	3	4 Sum.

8.—								
	7	4	5	8	3	4	2	
	2	5	4	1	6	5	8	
	6	7	8	6	4	2	3	
	3	2	1	3	5	7	7	
	5	6	2	5	4	8	3	
	4	3	7	4	5	1	7	
	3	8	4	3	4	7	8	
	6	1	5	6	5	2	2	
	5	1	0	0	0	0	3	K. L.
	4	5	1	0	0	0	0	3 Sum.

9.—								
	6	7	3	4	7	6	5	
	3	2	6	5	2	3	5	
	8	9	0	1	7	9	4	K. L.
	4	7	8	6	4	7	6	
	5	2	1	3	5	2	4	
	7	9	6	4	3	5	2	
	2	0	3	5	6	4	8	
	4	7	6	4	3	5	7	
	5	2	3	5	6	4	3	
	4	8	9	0	1	7	9	4

10.—								
	7	8	6	4	3	7	8	
	2	1	3	5	6	2	2	
	6	4	3	7	8	6	4	
	3	5	6	2	1	3	6	
	5	3	7	8	6	4	2	
	4	6	2	1	3	5	8	
	3	1	1	7	9	9	9	K. L.
	8	6	4	5	3	7	6	
	1	3	5	4	6	2	4	
	4	3	1	1	7	9	9	9

N.B.—K. L. denotes Key Line or Sum.

NOTE.—The foregoing plan may be used with great advantage in large schools. Enough has been said to render it explanatory to any capacity.

USE AND APPLICATION.

1.—A merchant on settling his accounts, finds he owes A. £60, B. £150, C £240, and to D. £100; I require to know how much he owes in all?—Ans. £550.

2.—A merchant is indebted to A. £4600, to B. £370, to C. £6000, to D. £1267, to E. £7640, to F. £.60; what sum did he owe in all?—Ans. £19937.

3.—A man born in the year 1853, when will he be 60 years old?—Ans. 1913.

4.—A merchant receives the following sums: £200, £317, £315, £10, £172, £513, and £9; what is the whole sum?—Ans. £1536.

5.—What is the weight of seven casks of merchandise, viz :—No. 1, weighing 960 lbs; No. 2, 725 lbs; No. 3, 830 lbs; No. 4, 798 lbs; No. 5, 697 lbs; No. 6, 569lbs; and No. 7, 987 lbs?—Ans. 5566 lbs.

6.—A. borrowed from B. a sum of money, and paid in part, £302, and the remainder is £30; what sum did A. borrow?—Ans. £332.

7.—At the Custom House, Liverpool, on the 1st of May, were entered 1200 lbs of tea; on the 16th, 1479 lbs; on the day following, 1941 lbs; the same day, 6195 lbs.; on the four last days of the same month, 1236 lbs. each day; how many lbs. were entered during the month?—Ans. 15759 lbs.

8.—Lord Raglan took out to the East 4000 foot soldiers, 4006 cavalry, 3093 light infantry, 1224 gunners, 1400 pioneers, and 200 miners; required the number of the whole army?—Ans. 13923 men.

9.—In the year 1854, the value of goods exported from Manchester to America was £59678; to China, £109900; to Australia, £178731; to India, £667101; to St. John's, £1602924; and to Spain, £1811268: required the amount.—Ans. £4429602.

QUERIES.—What is Addition? Why do you carry 1 for every 10? How do you prove Addition? How do you manage by the new method?

SIMPLE SUBTRACTION.

SUBTRACTION is the taking a less number from a greater. The remainder is the difference.

RULE.—Write down the figures, units under units, tens under tens, &c.; place the less under the greater; begin at the unit's place, and take the difference between it and the figure above, which write down for the remainder. If the figure below be greater than the figure above, add ten,* and then subtract; carry one for every ten so added throughout.

Method of Proof.—Add the remainder to the lesser number, and if both are equal to the greater, the work is right.

EXAMPLES.

	1.—From 4763	2.—8765	3.—7812	4.—9782	5.—4764238
	Take 3584	1234	5843	5476	4598758
Rem.	1179				
Proof	4763				

USE AND APPLICATION.

1.—Suppose A. was born in the year 1824, and B. in the year 1853; what is the difference of their ages?—Ans. 29 years.

2.—There are two numbers, the greater is 1795, and the difference 1695; what is the lesser number?—Ans. 100.

3.—Bought 14 cwt. of tobacco for £15400, and sold 8 cwt. for £8800; how many cwt. have I on hand, and what sum do I want to make first cost?—Ans. 6 cwt. and £6600 deficiency.

4.—In 5 bags were different sums of money, amounting to £1000. In the first £100, in the second £314, in the third £143, and in the fourth £209; what did the fifth contain?—Ans. £234.

5.—John Henry Quinn, Esq., of Dromore House, had an estate worth £1600 a year; he paid land tax £150, and quit rent £65; what was his estate worth per annum?—Ans. £1385.

QUERIES.—What is Subtraction? How must the numbers be placed? How do you prove Subtraction?

Reason.—The ten which is added by the rule is the value of an unit in the next place, by the nature of Notation; the one which is added to the next place of the lesser number, diminishes the correspondent place of the greater; so that it is only taking from one and adding so much to another, which never changes the total.

(1.)—MULTIPLICATION AND DIVISION TABLES, NEWLY COMBINED.

×2	÷2	×3	÷3	×4	÷4	×5	÷5	×6	÷6	×7	÷7	×8	÷8	×9	÷9	×10	÷10	×11	÷11	×12	÷12
2	4	2	6	2	8	2	10	2	12	2	14	2	16	2	18	2	20	2	22	2	24
3	6	3	9	3	12	3	15	3	18	3	21	3	24	3	27	3	30	3	33	3	36
4	8	4	12	4	16	4	20	4	24	4	28	4	32	4	36	4	40	4	44	4	48
5	10	5	15	5	20	5	25	5	30	5	35	5	40	5	45	5	50	5	55	5	60
6	12	6	18	6	24	6	30	6	36	6	42	6	48	6	54	6	60	6	66	6	72
7	14	7	21	7	28	7	35	7	42	7	49	7	56	7	63	7	70	7	77	7	84
8	16	8	24	8	32	8	40	8	48	8	56	8	64	8	72	8	80	8	88	8	96
9	18	9	27	9	36	9	45	9	54	9	63	9	72	9	81	9	90	9	99	9	108
10	20	10	30	10	40	10	50	10	60	10	70	10	80	10	90	10	100	10	110	10	120
11	22	11	33	11	44	11	55	11	66	11	77	11	88	11	99	11	110	11	121	11	132
12	24	12	36	12	48	12	60	12	72	12	84	12	96	12	108	12	120	12	132	12	144

(2.)—EXTENDED.

×13	÷13	×14	÷14	×15	÷15	×16	÷16	×17	÷17	×18	÷18	×19	÷19	×20	÷20
2	26	2	28	2	30	2	32	2	34	2	36	2	38	2	40
3	39	3	42	3	45	3	48	3	51	3	54	3	57	3	60
4	52	4	56	4	60	4	64	4	68	4	72	4	76	4	80
5	65	5	70	5	75	5	80	5	85	5	90	5	95	5	100
6	78	6	84	6	90	6	96	6	102	6	108	6	114	6	120
7	91	7	98	7	105	7	112	7	119	7	126	7	133	7	140
8	104	8	112	8	120	8	128	8	136	8	144	8	152	8	160
9	117	9	126	9	135	9	144	9	153	9	162	9	171	9	180
10	130	10	140	10	150	10	160	10	170	10	180	10	190	10	200
11	143	11	154	11	165	11	176	11	187	11	198	11	209	11	220
12	156	12	168	12	180	12	192	12	204	12	216	12	228	12	240
13	169	13	182	13	195	13	208	13	221	13	234	13	247	13	260
14	182	14	196	14	210	14	224	14	238	14	252	14	266	14	280
15	195	15	210	15	225	15	240	15	255	15	270	15	285	15	300
16	208	16	224	16	240	16	256	16	272	16	288	16	304	16	320
17	221	17	238	17	255	17	272	17	289	17	306	17	323	17	340
18	234	18	252	18	270	18	288	18	306	18	324	18	342	18	360
19	247	19	266	19	285	19	304	19	323	19	342	19	361	19	380
20	260	20	280	20	300	20	320	20	340	20	360	20	380	20	400

SIMPLE MULTIPLICATION.

MULTIPLICATION is a contracted method of addition, or repeating a given quantity as often as required. The number to be multiplied, is called the multiplicand; the number we multiply by, the multiplier; the number found, the product.

RULE.—Place the multiplier under the multiplicand, units under units, and tens under tens; draw a line, and multiply every figure in the multiplicand by each figure in the multiplier, observing to carry for the tens: add all into one sum for the product. The *reason* for placing the figures as directed is evident from the nature of numeration.

The true proof is by division—the presumptive proof is by the peculiar property of the number 9, which we subjoin hereafter.—Add all the digits of the multiplicand, rejecting the nines, which place to the left hand of the cross; do in like manner with the multiplier, placing the excess of nines to the right hand of the cross. Multiply these two sums, setting the excess of nines at the top of the cross; then cast out the nines in the product; and if the excess of nines be equal to the excess in the multiplicand and multiplier, the work is right.

CASE 1.

When the multiplier is any figure from 2 to 12, proceed thus:—

EXAMPLES.

1.—Multiply 34678946 by 2.

34678946
2
69357892 Ans.

2.—Multiply 67865431 by 7.

67865431
7
475058017 Ans.

3.—Multiply 374328756432 by 3.—Ans. 1122986269296.
4.—Multiply 5806342748 by 4.—Ans. 23225370992.
5.—Multiply 8435674 by 5.—Ans. 42178370.
6.—Multiply 274567546 by 6.—Ans. 1447405276.
7.—Multiply 54328432 by 8.—Ans. 434627456.
8.—Multiply 8643597 by 9.—Ans. 77792373.
9.—Multiply 79865342 by 11.—Ans. 878518762.

CASE 2.

When the multiplier is a composite number:—

RULE.—Multiply by the component parts. For example:—

1.—Multiply 376 by 21.

376
3
1128
7
7896 Ans.

2.—Multiply 98765432 by 32.

98765432
4
395061728
8
3160493824

3.—Multiply 9378964 by 42.—Ans. 393916488.
4.—Multiply 87698745 by 54.—Ans. 4735732230.

CASE 3.

If your multiplier be between 10 *and* 20.

RULE.—Multiply each figure in the multiplicand by the units of the multiplier, adding to each product its own back figure, and to the last figure add the tens, if any.

EXAMPLES.

5.—Multiply	385	6.—679	7.—4873	8.—6958	9.—7956	10.—7685
by	13	16	18	17	15	19
Ans.	5005	10864	87714	118286	119340	146015

If the multiplier be between 20 *and* 30.

RULE.—Multiply as above, and take the back figure double; add the tens to the last figure doubled.

EXAMPLES.

1.—Mul.	798	2.—567	3.—395	4.—395	5.—487	6.—6784	7.—123
by	22	23	23	27	27	28	29
Ans.	17556	13041	9085	10665	13149	189952	3567

CASE 4.

To multiply by 111, 112, 113, *and to* 119.

RULE.—Multiply as before; add to the product the two figures which stand next on the right hand, and to the last two figures add separately what you carry.

EXAMPLES.

1.—Mul.	2183	2.—4296	3.—5589	4.—6273	5.—7182	6.—83716
by	111	112	113	114	115	116
Ans.	242313	481152	631557	715122	825930	9711056

CASE 5.

To multiply by any number of nines.

RULE.—Add as many ciphers to the right hand of the multiplicand as there are nines in the multiplier, and from the result subtract the multiplicand, and the remainder will be the product.

EXAMPLES.

1.—Multiply 2368 by 999.

	2368000
	2368
Ans.	2365632

2.—Multiply 37568 by 999999.

	37568000000
	37568
Ans.	37567962432

CASE 6.

To multiply any number of figures without the aid of intermediate lines.

RULE.—Multiply the units of the multiplicand by the units of the multiplier; set down the units of the product and carry the tens: next, multiply the tens in the multiplicand by the units of the multiplier, to which add the product of the units of the multiplicand, multiplied by the tens in the multiplier, and the tens carried; then multiply the hundreds in the multiplicand by the units of the multiplier, adding the product of the tens in the multiplicand, multiplied by the tens in the multiplier, and the units in the multiplicand by the hundreds in the multiplier, and so on till you have multiplied by every figure in the multiplier.

EXAMPLES.

1.—Multiply 4765483 by 379	2.—9876547 5678	3.—5837654 3765	PROOF. 6 / 2 3 / 6
Ans. 1806118057	56079033866	21978767310	
4.—Multiply 76543208 by 4073	5.—61037047 36105	6.—84019073 70906	
Ans. 311760486184	2203742581935	5957456390138	
7.—Multiply 76547861 by 35798	8.—54013706 50917	9.—86785432 70169	
Ans. 2740260328078	2750215868402	6089646978008	

QUERIES.—What is Simple Multiplication? How many given numbers has it? What are they called? How are they to be placed in order to be multiplied? What is the answer in Multiplication called? What is a composite number? How do you multiply by a composite number? When you have ciphers intermixed, how do you manage them? When to the right hand of multiplicand or multiplier, what should you do with them? How is Multiplication proved? Repeat the rule for multiplying by any number of figures without intermediate lines.

SIMPLE DIVISION.

CASE 1.

DIVISION is the finding how often one number is contained in another. The number to be divided is called the dividend; the number you divide by, the divisor; the number found, the quotient.

RULE.—Set down your dividend, to the left of which place your divisor with a parenthesis between them, and the sign ÷ before; find how often the divisor is contained in the next figure or figures of the dividend. Multiply the divisor by the quotient, subtract the result and carry the remainder to the next dividend, and thus proceed.

Method of Proof.—Multiply the quotient by the divisor, adding in the remainder; the product will be equal to the dividend if the work be right.

EXAMPLES.

1.	2.	3.
Divide 76438646 by 2.	93765438 by 3.	67432679 by 4.
÷2) ———	÷3) ———	÷4) ———
Ans. 38219323	31255146	16858169 - 3 rem.

4.	5.	6.
Divide 87654327 by 5.	78647859 by 6.	98734210 by 7.
÷5) ———	÷6) ———	÷7) ———
Ans. 17530865 - 2 rem.	13107976 - 3 rem.	14104887 - 1 rem.

7.	8.	9.
Divide 87652398 by 8.	97654378 by 9.	540132765 by 10.
÷8) ———	÷9) ———	÷10) ———
Ans.		

CASE 2.—Long Division.

An original plan, more concise than either the French, German, or Italian methods; it may be acquired in a few hours. The operation combines an expansion of mind, with a quickness of perception, that will tend to make easy this once tedious and difficult rule.

Rule.—Write down your dividend to the left of your divisor with sign ÷ before it; separate the dividend and divisor as before; draw a horizontal line at a proper distance; find how often the first figure of the divisor is contained in the first figure or two of the dividend; write under the horizontal line as often as it will go; multiply the divisor by the quotient figure; subtract the result mentally from the dividend, casting out the multiplied figures: then, set the remainder in a perpendicular line, to read up with the next figures of the dividend, and so proceed till all be done.

EXAMPLES.

10.

÷14)	78	6	5	4	7	6	3	2	
	...	8	2	1	2	3	0	5	
		.	.	1.	1.	1	1.	.	
Quot.	5	6	1	8	1	9	7	3	$\frac{1}{14}$ rem.

11.

÷17)	23	7	8	6	9	5	4	7	
	...	6	6	5	3	5	4	0	
		.	1	1.	.	.	.	1	
Quot.	1	3	9	9	2	3	2	6	$\frac{5}{17}$ rem.

12.

÷18)	39	5	8	1	6	4	3	2	
	...	3	7	6	7	4	.	.	
		.	1	1	1	1	.	.	.
Quot.	2	1	9	8	9	8	0	1	$\frac{14}{18}$ rem.

13.

÷19)	43	7	6	5	2	7	8	9	
	...	5	.	.	8	6	0	3	
		.	.	.	.	.	1	1	
Quot.	2	3	0	3	4	3	5	7	$\frac{6}{19}$ rem.

14.

÷21) 56785463 5
... 4 . . 1 . 0 4
1 . . . . 2 1
Quot. 2704069 6 $\frac{10}{21}$ rem.

15.

÷26) 586713456
... 6 4 7 5 3 . .
. 1 1 1 2 . .
Quot. 22565902 $\frac{4}{26}$ rem.

16.

÷28) 31478697544
... 3 6 1 6 0 5 5 7
. . 1 . 1 2 . 2
Quot. 1124239194 $\frac{8}{28}$ rem.

17.

÷32) 476987546
... 5 8 1 . 7 9 2
1 2 . . 2 1 .
Quot. 1490586 0 $\frac{6}{32}$ rem.

18.

÷38) 478965432 9
...
Quot. rem.

19.

÷45) 786452347 8
...
Quot. rem.

20.

÷63) 78654786 9 7
...
Quot. rem.

21.

÷68) 987654786 8
...
Quot. rem.

22.

÷75) 869786486 9
...
Quot. rem.

23.

÷84) 78654786 5 7
...
Quot. rem.

24.

÷94) 1056786984 7
...
Quot. rem.

25.

÷98) 1456786474 8
...
Quot. rem.

26.

÷234) 7867854365 4
...
Quot. rem.

27.

÷346) 7869898642 7
...
Quot. rem.

28.

÷2465) 7869 7 6 5 4 3 2 7 8

Quot. ..... rem.

29.

÷578) 61543 4 8 3 7 6 9 5 8

Quot. ..... rem.

30.

÷9876) 58647 8 9 0 1 6 5 7 9

Quot. ..... rem.

31.

÷24786) 78654 7 8 6 9 7 6 8 9

Quot. ..... rem.

32.

÷10765) 87654 8 7 6 5 4 6 8 9

Quot. ..... rem.

33.

÷27654) 98765 7 8 6 4 5 9 7 6

Quot. ..... rem.

QUERIES.—What is Simple Division? How many given numbers hath it? What do you call the number you divide by? What term do you give the number to be divided? What is the result called? Can you divide by composite numbers? How do you prove Division? Repeat the rule for the new method.

REDUCTION

OF COINS, WEIGHTS, AND MEASURES.

REDUCTION is twofold, viz.,—descending and ascending. First, all great names are brought into small ones by multiplying with so many of the lesser as make one of the greater; second, all small names are brought into greater by dividing with so many of the less as make one of the greater.

To perform by multiplication, reduce the greatest denomination to the next less, adding in the less; reduce this sum to the next lower name, adding the numbers belonging thereto, and so proceed till the lowest.

To perform by division is the converse of that by multiplication: divide the lowest denomination by so many of these as make one of the greater, and so on till the highest.

PENCE, SHILLINGS, AND POUND TABLES COMBINED.

D.		£	S.	D.	D.		£	S.	D.	S.		£	S.	D.
12	are	0	1	0	2000	are	8	6	8	20	are	1	0	0
20	...	0	1	8	2160	...	9	0	0	30	...	1	10	0
24	...	0	2	0	2400	...	10	0	0	40	...	2	0	0
30	...	0	2	6	2500	...	10	8	4	50	...	2	10	0
36	...	0	3	0	2640	...	11	0	0	60	...	3	0	0
40	...	0	3	4	2880	..	12	0	0	70	...	3	10	0
48	...	0	4	0	3000	...	12	10	0	80	...	4	0	0
50	...	0	4	2	3120	...	13	0	0	90	...	4	10	0
60	...	0	5	0	3360	...	14	0	0	100	...	5	0	0
70	...	0	5	10	3500	...	14	11	8	110	...	5	10	0
72	...	0	6	0	3600	...	15	0	0	120	...	6	0	0
80	...	0	6	8	3840	...	16	0	0	130	...	6	10	0
84	...	0	7	0	4000	...	16	13	4	140	...	7	0	0
90	...	0	7	6	4500	...	18	18	4	150	...	7	10	0
96	...	0	8	0	5000	...	20	16	8	160	...	8	0	0
100	...	0	8	4	5500	...	22	18	4	170	...	8	10	0
108	...	0	9	0	6000	...	25	0	0	180	...	9	0	0
110	...	0	9	2	6500	...	27	1	8	190	...	9	10	0
120	...	0	10	0	7000	...	29	3	4	200	...	10	0	0
130	...	0	10	10	7500	...	31	5	0	210	...	10	10	0
132	...	0	11	0	8000	...	33	6	8	220	...	11	0	0
140	...	0	11	8	8500	...	35	8	4	230	...	11	10	0
144	...	0	12	0	9000	...	37	10	0	240	...	12	0	0
150	...	0	12	6	9500	...	39	11	8	250	...	12	10	0
156	...	0	13	0	10000	...	41	13	4	260	...	13	0	0
160	...	0	13	4	11000	...	45	16	8	270	...	13	10	0
168	...	0	14	0	12000	...	50	0	0	280	...	14	0	0
170	...	0	14	2	13000	...	54	13	4	290	...	14	10	0
200	...	0	16	8	14000	...	58	6	8	300	...	15	0	0
240	...	1	0	0	15000	...	62	10	0	400	...	20	0	0
300	...	1	5	0	16000	...	66	13	4	500	...	25	0	0
400	...	1	13	4	17000	...	70	16	8	600	...	30	0	0
480	...	2	0	0	18000	...	75	0	0	700	...	35	0	0
500	...	2	1	8	19000	...	79	3	4	800	...	40	0	0
600	...	2	10	0	20000	...	83	6	8	900	...	45	0	0
700	...	2	18	4	21000	...	87	10	0	1000	...	50	0	0
720	...	3	0	0	30000	...	125	0	0	2000	...	100	0	0
800	...	3	6	8	40000	...	166	13	4	3000	...	150	0	0
900	...	3	15	0	50000	...	208	6	8	4000	...	200	0	0
960	...	4	0	0	60000	...	250	0	0	5000	...	250	0	0
1000	...	4	3	4	70000	...	291	13	4	6000	...	300	0	0
1200	...	5	0	0	80000	...	333	6	8	7000	...	350	0	0
1440	...	6	0	0	90000	...	375	0	0	8000	...	400	0	0
1500	...	6	5	0	100000	...	416	13	4	9000	...	450	0	0
1680	...	7	0	0	200000	...	833	6	8	10000	...	500	0	0
1920	...	8	0	0	240000	...	1000	0	0	12000	...	600	0	0

NOTE.—In the early ages of commerce there was no occasion for computation; one commodity was bartered for another. As civilization advanced, improvements were made, and something was added to the conveniences of trade. To remove the difficulty, gold and silver, being the most precious metals, were universally adopted: but as the expense in the working of gold was much greater than the charge for working silver, the higher value was justly ascribed to the former. It was then found necessary to fix a proportion between these metals; and hence, one ounce of gold was considered worth about fifteen ounces of silver: however, it was soon found necessary to impress coins with a mark of distinction, expressing the value each piece contained. The pound troy was selected as the standard to regulate the money of this realm. Two centuries before the conquest, Osbright, then king of England, had one ounce troy of silver divided into twenty pieces, called pence, so that an ounce of silver then was not worth more than 1s. 8d., which continued until the reign of Henry VII., who valued the same at 2s. 6d., and so it remained until the time of Edward IV., who valued the ounce at 3s. 4d. Henry VIII. valued the ounce of silver at 3s. 9d., which continued to Queen Elizabeth's time; she increased the value of the ounce troy to 5s., as it remains to this day.

GENERAL RULE.—All great names are made less by multiplication. All less names are made greater by division. Pounds multiplied by 20 are shillings; shillings by 12 are pence; pence by 2 are halfpence; and halfpence by 2 are farthings. Farthings divided by 2 are halfpence; halfpence by 2 are pence; pence by 12 are shillings; and shillings by 20 are pounds.

EXAMPLES.

1—Reduce £247 to shillings.

20

Ans. 4940s.

2—Reduce 468s. to pence.

12

Ans. 5616d.

3—Reduce 273d. to farthings.

4

Ans. 1092q.

4—Reduce £55 19s. 7d. to pence.

20

1119

12

Ans. 13435d.

5—Reduce £754 17s. 9¾d. to farthings.

20

15097

12

181173

4

Ans. 724695q.

6—In 7656s. how many pounds?

÷ 2,0) 765,6s.

Ans. £382 16s.

7—In 89594d. how many shillings?

÷ 12) 89594d.

Ans. 7466s. 2d.

8—In 345600q. how many pounds?
÷ 960) 345600q.
6.
7.
5.
Ans. £360

9—In 960000q how many pounds?
÷ 960) 960,000q.
...
...
...
Ans. £1000

10—In £478 how many pence?
£478
240
Ans. 114720d.

11—In 114720d. how many pounds?
÷ 240) 114720d.
72.
89.
11.
Ans. £478

12—In 748800d. how many pounds?
÷ 240) 748800d.
88.
24.
Ans. £3120

13—In 7376640q how many pounds?
÷ 960) 7376640q.
664.
508.
683.
Ans. £7684

New Rule for bringing Shillings to Pounds.—First, take the units and tens as so many pounds and shillings; write down the shillings, then multiply the hundreds mentally by 5, adding in the pounds, and you have the pounds and shillings.

EXAMPLE.

In 786543s. how many pounds and shillings?
5,
Ans. £39327 3s.

QUERIES.—What is Reduction? What does Reduction ascending mean? What does Reduction descending signify? How is reduction proved? How do you bring pounds to farthings? How do you bring farthings to pounds? How do you bring halfpence to pounds? and *vice versa*.

WEIGHTS AND MEASURES.

TROY WEIGHT.

TROY WEIGHT has its name from Troyes, a town in France, in the province of Champagne, and department of the Aube, and was introduced by William the Conqueror: by it are weighed gold, silver, jewels, and liquors. Its denominations are as follow:—

4 Grains.....make	...	...	1 Carat*
6 Carats, or 24 Grains	...	...	1 Pennyweight.
20 Pennyweights	...	...	1 Ounce.
12 Ounces ...	...	...	1 Pound.
25 Pounds ...	...	...	1 Quarter.
100 Pounds ...	...	...	1 Hundred Weight.
20 Hundred Weight	...	...	1 Ton of Gold or Silver.

NEW TABLE OF TROY WEIGHT.

OZ.	DWTS.	GRS.	lb.	OZ.	DWTS.	GRS.
12	0	0	1	12	240	5760
0	20	0	$\frac{1}{12}$	1	20	480
0	1	24	$\frac{1}{240}$	$\frac{1}{24}$	1	24
0	0	1	$\frac{1}{5760}$	$\frac{1}{480}$	$\frac{1}{24}$	1
6	0	0	$\frac{1}{2}$	.....	.....	.....
4	0	0	$\frac{1}{3}$	.....	.....	.....
3	0	0	$\frac{1}{4}$	.....	.....	.....
2	8	0	$\frac{1}{5}$	.....	.....	.....
2	0	0	$\frac{1}{6}$	.....	.....	.....
1	10	0	$\frac{1}{8}$	.....	.....	.....
1	0	0	$\frac{1}{12}$	.....	.....	.....
0	10	0	$\frac{1}{24}$	$\frac{1}{2}$	.....	.....
0	6	16	$\frac{1}{36}$	$\frac{2}{3}$	.....	.....
0	5	0	$\frac{1}{48}$	$\frac{1}{4}$	.....	.....
0	4	0	$\frac{1}{60}$	$\frac{1}{5}$	.....	.....
0	3	8	$\frac{1}{72}$	$\frac{1}{6}$	.....	.....
0	2	12	$\frac{1}{96}$	$\frac{1}{8}$	.....	.....
0	2	0	$\frac{1}{120}$	$\frac{1}{10}$	.....	.....
0	1	16	$\frac{1}{144}$	$\frac{1}{12}$	.....	.....
0	1	0	$\frac{1}{240}$	$\frac{1}{20}$	1	.....
0	0	12	$\frac{1}{480}$	$\frac{1}{40}$	$\frac{1}{2}$	.....
0	0	6	$\frac{1}{960}$	$\frac{1}{80}$	$\frac{1}{4}$	.....
0	0	4	$\frac{1}{1440}$	$\frac{1}{120}$	$\frac{1}{6}$	.....
0	0	3	$\frac{1}{1920}$	$\frac{1}{160}$	$\frac{1}{8}$	.....
0	0	2	$\frac{1}{2880}$	$\frac{1}{240}$	$\frac{1}{12}$	.....
0	0	1	$\frac{1}{5760}$	$\frac{1}{480}$	$\frac{1}{24}$	.....

RULE.—Pounds multiplied by 12 are ounces; ounces by 20 are pennyweights; pennyweights by 24 are grains; and grains by 4 are carats; carats divided by 4 are grains; grains by 24 are pennyweights; pennyweights by 20 are ounces; ounces by 12 are pounds.

* The standard for gold coin is 22 carats, fine gold, and 2 carats copper; for silver 11 oz., 2 dwts and 18 dwts. copper.

EXAMPLES.

1.—In 24 ℔ troy, how many ounces, pennyweights, and grains?—Ans. 288 oz. 5760 dwts. 138240 grs.
2.—How many pounds troy in 138240 grains?—Ans. 24 ℔s.
3.—How many pounds troy are in 85960 grains?—Ans. 14 ℔. 11 oz. 1 dwt. 16 grs.
4.—In 14 ℔. 11 oz. 1 dwt. 16 grs. how many grains?—Ans. 85960 grs.
5.—In 75 ℔. 11 oz. 19 dwts. 23 grs. how many grs.?—Ans 437759 grs.
6.—In 437759 grains how many pounds troy?—Ans. 75 ℔. 11 oz. 19 dwts. 23 grains.
7.—In 16 ℔. 0 oz. 14 dwts. 21 grs., how many grains?—Ans. 92517 grs.
8.—In 92517 grains, how many pounds troy?—.Ans 16 ℔. 0 oz. 14 dwts. 21 grs.
9.—Sold 8 silver teapots, each weighing 3 ℔. 9 oz. 18 dwts. 13 grains; how many grains were in all?—Ans. 176360 grs.
10.—In 176360 grains, how many pounds?—Ans. 30 ℔. 7 oz. 8 dwts. 8 grs.
11.—What quantity of gold will it require to make twelve ornaments, each weighing 1 oz. 18 dwts. 12 grs.?—Ans. 23 oz. 2 dwts.
12.—How many silver tablespoons, each weighing 4 oz. 14 dwts., can be made out of 2 ℔. 4 oz. 4 dwts. of silver?—Ans. 6 spoons.

QUERIES.—How do you bring lbs. troy into grains? How do you bring grains into lbs? How many grains in a lb. troy? What are the goods usually weighed by troy weight?

AVOIRDUPOIS WEIGHT*

Signifies a medium of weight: by it are weighed all goods that are subject to waste, as groceries, tallow, pitch, hemp, flax, wool, and all kinds of metals, except gold and silver.

COMMON WEIGHT.

16 drs.	1 oz.	2 stone or 28 ℔.	1 qr.
16 oz.	1 ℔.	4 qrs.	1 cwt.
14 ℔.	1 stone.	20 cwt.	1 ton.

---

* The corresponding proportion between avoirdupois and troy weight.

1 lb. Avoirdupois weight = 14 oz. 11 dwts. 16 gr. troy = 7000 gr.
1 oz. „ „ = 18 dwts. 5½ gr. = 437½ gr.
1 dr. „ „ = 1 dwt. 3½ gr.
1 lb. Troy = 13 oz. 2.65⅐ dr.—Avoirdupois = 210.65⅐ dr.
1 oz. Troy = 1 oz. 1.55⅜ dr.—Avoirdupois = 17.55⅜ dr.

A pound Avoirdupois contains 7000 gr. nearly, and a pound Troy 5760 gr.; consequently they are to each other as 17 to 14; or multiply the pounds Troy by 144, and divide by 175, and you will have the pounds Avoirdupois.

WOOL WEIGHT.

In some parts of England, 15 lb. make a stone; in Ireland, 16 lb. to the stone.

England.

15 lb.	... ...	1 stone.
2 stones or 30 lb.		1 tod.
8 tods or 240 lb.		1 pack or sack.

Otherwise.

7 lb.	... ...	1 clove.
2 cloves	... ...	1 stone.
2 stones	... ...	1 tod.
6½ tods	... ...	1 wey.
2 weys	... ...	1 sack.
12 sacks	... ...	1 last.

NEW TABLE OF AVOIRDUPOIS WEIGHT.

CWTS.	QRS.	LBS.		TON.	CWTS.	QRS.	STONES.	LBS.	OZ.	DRS.
20	0	0	are	1	20	80	160	2240	35840	573440
10	0	0	...	½	...	...	...	...	...	...
5	0	0	...	¼	...	...	...	...	...	...
4	0	0	...	⅕	...	...	...	...	...	...
2	3	12	...	⅛	...	...	...	...	...	...
2	2	0	...	1/10	...	...	...	...	...	...
2	0	0	...	1/10	...	...	...	...	...	...
1	1	0	...	1/16	...	...	...	...	...	...
0	2	0	...	1/20	...	...	...	...	...	...
0	1	0	is	1/40	...	1	...	...	...	...
1st.	0lb.		are	1/80	...	...	1	...	...	...
0	8		...	1/160	...	...	½	8	...	...
0	7		...	1/160	1/20	1/80	⅛	7	...	...
0	4		...	1/160	1/20	1/80	¼	4	...	...
0	3½		...	1/160	1/20	1/80	1/16	3½	...	...
0	1		is	1/160	1/20	1/80	1/16	1	...	...
	1oz.		...	1/2560	1/320	1/1280	1/256	1/16	1	...
	1dr.		...	1/40960	1/5120	1/20480	1/4096	1/256	1/16	1

CUSTOMARY WEIGHT USED IN BUYING AND SELLING THE FOLLOWING COMMODITIES:

	lbs.
A Firkin of Butter is	56
A Firkin of Soap	64
A Barrel of Soap	256
A Barrel of Pot Ashes	200
A Barrel of Anchovies	30
A Barrel of Figs, from 96 lbs. to 2¼ cwt.	
A Barrel of Candles	120
A Barrel of Butter	224
A Puncheon of Prunes, 10 or 12 cwt.	
A Fother of Lead, 19 cwt. 2 qrs., or	2184
A Stone of Iron or Shot ...	14
A Gallon of Train Oil	10¼
A Fagot of Steel	120

CUSTOMARY WEIGHT OF GOODS (CONTINUED.)

	lbs.	OZ.	DR
A Stone of Glass	5		
A Quintal of Fish in Newfoundland	100		
A Seam of Glass, 24 stone, or	120		
A Stone of Cheese	16		
A Stone of Meat in London ...	8		
A Stone of Meat in the Country	14		
A Stone of Hemp	32		
A Stone, Horseman's Weight...	14		
A Chest of Tea	84		
A Load of Meal, Potatoes ...	240		
A Peck Loaf Weighs ...	17	6	1
A Half-Peck...	8	11	0
A Quartern	4	5	8
A Peck (or Stone) of Flour	14	0	0
A Bushel of Flour ...	56	0	0
A Barrel of American Flour	196	0	0
A Pack, or Load of Flour	240	0	0
A Sack, or five Bushels of Flour*	280	0	0

SIZES OF BOOKS.

4 pages, or 2 leaves ...	1 sheet ffo.
8 pages, or 4 leaves ...	1 sheet quarto, or 4to.
16 pages, or 8 leaves ...	1 sheet octavo, or 8vo.
24 pages, or 12 leaves ...	1 sheet duodecimo, or 12mo.
36 pages, or 18 leaves ...	1 sheet eighteens, or 18mo.
72 words in Common Law ...	1 sheet.
80 words in Exchequer	1 sheet.
90 words in Chancery	1 sheet.

PAPER.

24 sheets	1 quire.
20 sheets	1 quire, outside.
25 sheets	1 printer's quire.
21½ quires, or 516 sheets	1 printer's ream.
20 quires, or 472 sheets	1 ream of paper.
2 reams	1 bundle.
10 reams	1 bale.
5 dozen parchment	1 roll.

* In some parts of England, a sack of Flour is 18 stones, or 252 pounds.

A COMPENDIOUS METHOD OF REDUCING HUNDREDS, QUARTERS, AND POUNDS, TO POUNDS.

RULE.—Multiply the cwts. by 12, and to the product mentally add the lbs. of the odd weight, which sum is to be so placed under the cwts. that the place of hundreds in this may fall under the units of that: the whole added will give the answer.

EXAMPLES.

13.—123 cwt. 3 qrs. 10 lbs. how many lbs.?

cwt. qrs. lbs. lbs.	Or thus:	cwt. qrs. lbs.	*The common method.* cwt. qrs. lbs.
123 3 10=94		123 3 10	123 5 10
1570*		123	4
		123	
Ans. 13870 lbs.		12394	495
			28
	Ans.	13870 lbs.	3960
			991
			Ans. 13870 lbs.

14.—In 36 cwt. 1 qr. 13 lbs. how many lbs.?—Ans. 4073 lbs.

15.—In 75 cwt. 3 qrs. 14 lbs. how many lbs.?

cwt. qrs. lbs.
75 3 14
998
Ans. 8498 lbs.

16.—In 273 cwt. 2 qrs. 19 lbs. how many lbs.?—Ans. 30651 lbs.

17.—In 13870 lbs. how many cwts.?

lbs.		
÷ 112) 13870	÷ 28) 94	10
	6	3
	2	4
Ans. cwt. 123	3 qrs.	10 lbs.

18.—In 264 cwts. 3 qrs. 12 lbs. 11 oz. how many oz.?—Ans. 474635 oz.
19.—In 474635 oz. how many cwts.?—Ans. 264 cwt. 3 qrs. 12 lbs. 11 oz.
20.—In 139 cwt. 1 qr. 22 lbs. 13 oz. how many oz.?—Ans. 249901 oz.
21.—In 249901 oz. how many cwts.?—Ans. 139 cwt. 1 qr. 22 lbs. 13 oz.
22.—In 976 cwt. 3 qrs. 27 lbs. how many lbs.?—Ans. 109423 lbs.
23.—Bought 24 bags of flour, each weighing 2 cwt. 2 qrs. 13 lbs., how many lbs. in all?—Ans. 7032 lbs.
24.—In 3 cwt. 2 qrs. 14 lbs. of sugar, how many parcels are there, each containing half a pound?—Ans. 812 parcels.

QUERIES.—How do you bring lbs. avoirdupois to drachms? How do you bring drachms into pounds weight? How do you bring cwts., qrs., and lbs to lbs.? How do you bring lbs. to cwts.? Tons, cwts., qrs., and lbs. to lbs., and the reverse?

* The new method, 4 figures, exclusive of the answer; the common method, 14

To bring Short Weight to Long, and Long Weight to Short.

GENERAL RULE.—From the short weight in cwts., qrs., and lbs., take the $\frac{1}{15}$ of itself, and the remainder is long weight; and to the long weight in cwts., qrs., and lbs., add its $\frac{1}{14}$, and it is short weight of 112 lbs. to the cwt.

Reason.—8 lbs. being the difference—112 lbs. in one case, and 120 in the other. 8 is the 14th of 112, and the 15th of 120; consequently, the 15th taken from the short weight, leaves the long weight of 120 lbs.; and the 14th added to the long weight, make the short weight of 112 lbs.

EXAMPLES.

25.—In 135 cwt. of 112 lbs., how many cwts. of 120 lbs.?—Ans. 126 cwt.

26.—In 347 cwt. 1 qr. 16 lbs. short weight, how many long weight?—Ans. 324 cwt. 0 qr. 26 $\frac{2}{7}$ lbs.

27.—In 45 cwt. 1 qr. 17 lbs. short weight, how many long?—Ans. 42 cwt. 1 qr. 14 lbs.

28.—In 176 cwt. 3 qrs. 19 lbs. long weight, how many short weight?—Ans. 189 cwt. 2 qrs. 5 $\frac{5}{14}$ lbs.

QUERY.—How do you bring long weight to short, and the reverse?

CHEMISTS' WEIGHT

Is the same as troy; a chemist's lb. is=to a pound troy, and contains the same number of oz. and grs.; but instead of dwts. the oz. is divided into *scruples* and *drachms:* by it chemists and apothecaries compound their medicines, but buy by avoirdupois. The denominations are—grains, scruples, drachms, ounces, and pounds.

20 grains	1 scruple ℈	8 drachms	1 ounce ʒ
3 scruples	1 drachm ʒ	12 ounces...	1 pound ℔

RULE *for reducing to the lowest, or bringing to the highest denomination.*

Lbs.	× by 12 are ounces.	Grs.	÷ by 20 are scruples.
Oz.	× by 8 are drachms.	Scrs.	÷ by 3 are drachms.
Drs.	× by 8 are scruples.	Drs.	÷ by 8 are ounces.
Scrs.	× by 20 are grains.	Oz.	÷ by 12 are pounds.

NOTE.—The same grain, ounce, and pound, as troy weight, only differently divided and subdivided.

APOTHECARIES' FLUID MEASURE.

60 minims*	make	1 fluidrachm.	ʒ
8 fluidrachms		1 fluid ounce.	℥
16 fluid ounces		1 pint.	O
8 pints		1 gallon.	*cong.*

* The Edinburgh and Dublin Colleges still retain the term *gutta* (drop), instead of *minim*.

ABBREVIATIONS EMPLOYED BY THE FACULTY IN PRESCRIPTIONS, &c.

℞. (for recipe) take	q. s. (quantum sufficit) a sufficient quantity.
ss. (for semis) the half	
cochl. (cochleare) a spoonful	cong. (congius) a gallon.

M. (Manipulus), a handful, or M. (for Mice) mix.

P. (pugillum) as much as can be taken between the two forefingers and the thumb.

The quantities in prescriptions are expressed by small Roman numerals; thus,—

gt. j. (for gutta 1) 1 drop.	ʒ vij. 7 drachms.
♏ ij. 2 minims or drops.	ʒ iijss. 3½ drachms.
♏ iv. 4 minims.	f ʒ ij. 2 fluidrachms.
♏ xij. 12 minims.	℥ j. 1 ounce.
gr. xxvj. 26 grains.	℥ ss. half ounce.
℈ j. 1 scruple.	lb. ijss. 2½ lbs.
℈ ss. half a scruple.	0. iij. 3 pints.

EXAMPLES.

29.—How many pounds in 4896 scruples?—Ans. 17 lbs.

30.—A patient is allowed to take daily 2 drs. 2 scrs. of bark, how long will 7 lbs. last him?—Ans. 252 days.

31.—How many grains are in 231 lbs. 3 oz. 5 grs.?—Ans. 1332005 grs.

32.—In 1332005 grains how many pounds?—Ans. 231 lbs. 3 oz. 5 grs.

33.—In 7 oz. 5 drs. 3 scrs. how many scruples?—Ans. 186 scruples.

LINEAL OR LONG MEASURE.

3	barley-corns, b. c., are	1 inch, in.
4	inches, or 12 b. c.	1 hand, h.
12	inches, or 3 h.	1 foot, ft.
3	feet, or 36 inches	1 yard, yd.
5	feet, or 60 in.	1 pace, p.
2	yards, or 6 ft.	1 fathom, f.
5½	yards, or 16½ ft.	1 roll, pole, or perch.
7	yards, a perch Irish	
4	poles, or 22 yds.	1 land chain, 1 ch.
40	rods, or 10 ch., or 220 yds.	1 furlong, fur.
8	furlongs, or 80 ch., or 1760 yds.	1 mile, m.
3	miles, or 5280 yds.	1 league, l.
69½	miles, English statute	1 degree, d.
360	degrees the circumference of the globe.	

A nautical mile, 6075,81 feet.

The earth's circumference is equal to 131237500 feet, or 24855 miles, very nearly.

NOTE.—An inch is divided into 8 parts, by joiners, engineers, and mechanics; into 10 parts by surveyors, architects, and others; and 12 parts when used duodecimally. The chain used for measuring land is 66 feet, and it is divided into 100 links, each of them 7·92 inches.

Comparison of Foreign Measures of Length with England.

	Yards		Yards
Mile in England	1760	Small League in Germany ...	5866
„ Scotland	1984	„ Spain	5028
„ Ireland	2200	„ Poland	4400
Small League in France ...	2933	„ Hungary	8800
„ Mean ditto ...	3666	„ Ancient Greece	1624
„ Large ditto ...	4400	„ Sweden and Denmark .	7233
„ Italy	1467	„ Russia (verst)	1167

THE DISTANCES OF THE COMMERCIAL CITIES IN THE WORLD FROM LONDON.

		Distances from London.			Distances from London.
Algiers ...	... *Africa* ..	... 900	Lisbon ...	... *Portugal* ...	720
Amsterdam	... *Holland*	... 180	Madrid ...	... *Spain* ...	... 660
Antwerp ...	... *Netherlands* .	212	Mecca ...	... *Arabia*	... 1860
Baltimore '	... *United States*	2200	Mexico ...	... *N. America*..	3240
Berlin ...	... *Prussia*	... 360	Milan ...	... *Italy* ...	... 380
Berne ...	... *Switzerland*..	300	Morocco ...	... *Africa*	... 1200
Boulogne	... *France*..	... 101	Munich ...	... *Germany*	... 310
Brussels ...	... *Belgium*	... 209	Naples ...	... *Italy* ...	... 660
Bogota ...	... *S. America*..	3240	New York	... *United States*	2100
Boston ...	... *United States*	2000	Paris ...	... *France*	... 227
Buenos Ayres ..	*S. America*..	4620	Pekin ...	... *China* ...	... 3480
Cairo ...	... *Egypt* ...	.., 1320	Philadelphia	... *United States*	2170
Calais ...	... *France*	... 95	Quebec ...	... *Canada*	... 1920
Calcutta ...	... *East Indies*..	2580	Rio Janeiro	... *S. America*..	4080
Cashmere	... *Asia* ...	... 2220	Rome ...	... *Italy* ...	... 600
Constantinople .	*Turkey*	... 900	St. Petersburgh.	*Russia*	... 990
Copenhagen	... *Denmark*	... 480	Samarcand	... *Tartary*	... 1860
Delhi ...	... *East Indies*..	2580	Siam ...	... *East Indies*..	3630
Dieppe ...	... *France*	... 127	Stockholm	... *Sweden*	... 720
Dresden ...	... *Saxony*	... 360	Stutgard ...	... *Germany*	... 270
Florence ...	... *Italy* ...	... 480	Timbuctoo	... *Africa*	... 2220
Genoa ...	... *Italy* ...	... 420	Tonquin ...	... *China* ...	... 3540
Hamburgh	... *Hanseatic City*	320	Tunis ...	... *Africa*	... 900
Hanover ...	... *Germany*	... 300	Turin ...	... *Sardinia*	... 390
Havre ...	... *France*	... 160	Venice ...	... *Italy* ...	... 430
Ipsahan ...	... *Persia*	... 1690	Vienna ...	... *Austria*	... 420
Jeddo ...	... *Japan* ...	... 4200	Warsaw ...	... *Poland*	... 450
Lima ...	... *S. America*..	3900	Washington	... *United States*	2280

RULE.—Miles multiplied by 8 are furlongs; furlongs by 40 are poles; poles by 16½ are feet (English); poles by 21 are feet (Irish); feet by 12 are inches; and inches by 3 are barleycorns.

EXAMPLES.

34.—In 273 miles how many inches?—Ans. 17297280 inches.
35.—In 17297280 inches how many miles?—Ans. 273 English.
36.—In 273 Irish miles how many inches?—Ans. 22014720 in. Irish.
37.—How many miles in 22014720 inches?—Ans. 273 Irish.
38.—In 45 m. 3 fur. 4 yds. 2 ft. how many feet?—Ans. 304934 ft., Irish.
39.—How many miles in 304934 feet, Irish?—Ans. 45 miles, 3 furlongs, 4 yards, 2 feet.

QUERIES.—How many yards in an English mile? How many in a Scotch mile? How many in an Irish mile? Tell me the yards in a league, in France, Germany, Spain, Poland, Hungary, Greece, Sweden, Denmark, and Russia?

CLOTH MEASURE.

Hollands are measured by the ell (English), and tapestry by the ell (Flemish). The weaving of muslin is paid for by the ell (English), but bought and sold by the yard. Linens, woollens, wrought silk, and tape, are sold by the yard.

2¼ inches...make... ... 1 nail.	3 quarters ... ... 1 Flemish ell.
4 nails ... ... 1 quarter.	5 quarters ... ... 1 English ell.
4 quarters ... ... 1 yard.	4⅕ qrs. (37 in.) ... 1 Scotch ell.

6 quarters ... ... 1 French ell.

Ells (French)	×	by 3, and	÷	by 2 are yards.
Yards —	×	by 2, and	÷	by 3 are ells—French.
Yards —	×	by 4, and	÷	by 3 are ells—Flemish.
Yards —	×	by 4, and	÷	by 5 are ells—English.
Ells (French)	×	by 6, and	÷	by 5 are ells—English.
Ells (English)	×	by 5, and	÷	by 4 are yards.
Ells (Flemish)	×	by 3, and	÷	by 4 are yards.
Ells (French)	×	by 2, are ells—Flemish.		
Ells (English)	×	by 5, and	÷	by 6 are ells—French.
Ells (English)	×	by 5, and	÷	by 3 are ells—Flemish.
Ells (Flemish)	×	by 3, and	÷	by 5 are ells—English.
Ells (Flemish)	×	by 2, are French ells.		

RULE.—Yards multiplied by 4 are quarters; quarters by 4 are nails; yards by 3 are quarters Flemish; yards by 5 are quarters English; yards by 6 are quarters French.

EXAMPLES.

40.—How many nails in 40 yards?—Ans. 640 nails.
41.—In 640 nails how many yards?—Ans. 40 yards.
42.—In 20 yds. 3 qrs. 1 nail how many nails?—Ans. 333 nails.
43.—How many yards are in 333 nails?—Ans 20 yds. 3 qrs. 1 nail.

44.—How many quarters in 30 yds. 3 qrs.?—Ans. 123 qrs.
45.—How many quarters in 40 ells English?—Ans. 200 qrs.
46.—In 200 quarters how many ells English?—Ans. 40 ells English.
47.—How many yards in 2384 nails?—Ans. 149 yards.

QUERIES.—How are yards brought to ells? How are nails brought to yards? How are ells English brought to ells Flemish? How are ells Flemish brought to ells English? Bring ells English to yards. Ells Flemish to French ells.

YARN MEASURE.

COTTON YARN.					WORSTED YARN.			
Inches.	Threads.	Skeins, Leas or Raps.	Hanks, or 560 yards.	Spindle.	Inches.	Threads	Leas or Raps.	Hank, or 550 yards.
54	= 1	....	....	....	36	= 1	....	....
4320	80	= 1	....	....	2860	80	= 1	....
30240	560	7	= 1	....	20160	560	7	= 1
544320	10080	126	18	= 1	....	....	....	....

LINT OR LINEN YARN.

Inches.	Yards.	Threads.	Leas. Cuts, or Raps.	Beers.	Slips.	Hasps.	Spindles	Bundle.
36	= 1	...	...	...	...	...	...	...
90	$2\frac{1}{2}$	= 1	...	...	...	...	...	...
10800	300	120	= 1	...	...	...	...	...
21600	600	240	2	= 1	...	...	...	...
108000	3000	1200	10	5	= 1	...	...	...
129600	3600	1440	12	6	$1\frac{1}{2}$	= 1	...	...
518400	14400	5760	48	24	$4\frac{4}{5}$	4	= 1	...
2160000	60000	24000	200	100	20	$16\frac{2}{3}$	$4\frac{1}{6}$	= 1

NOTE.—Ermland yarn is $85\frac{1}{2}$ *in.* to one thread, and 40 *thd.* to one lea; Hamburgh yarn is 80 *in.* to one thread, and 90 *thd.* to one lea. Also, the cotton-reel is 54 *in.* in circuit; the linen-reel is 90 *in.*; the worsted-reel is 30 *in.*; the ounce-thread reel is 30 *in.*; and a hank of this yarn is 30 *thd.*

IMPERIAL LIQUID MEASURE,

Established by Act of Parliament, as a General Measure of Capacity for Liquid and Dry Articles.

The Imperial Gallon is the legal standard for regulating all other measures. It must contain 10 lbs. Avoirdupois Weight of pure water, and at the temperature of 62 degrees of Fahrenheit's thermometer. This quantity measures $277\frac{1}{4}$ cubic inches, very nearly; being about one-fifth greater than the old Wine Measure, one thirty-second greater than the old Dry Measure, and one-sixtieth less than the old Ale Measure.

IN WINE OR SPIRIT MEASURE,

2 pints*	make	1 quart.	84 gallons ... make ... 1 puncheon.
4 quarts	...	1 gallon.†	2 hhds. or 126 gals. . 1 pipe or butt.
63 gallons	...	1 hogshead.‡	4 hhds. or 252 gals. . 1 tun.

IN ALE, BEER, AND PORTER MEASURE,

2 pints ...	make	1 quart.	2 kilderkins, or 36 gals. 1 barrel.
4 quarts	...	1 gallon.	3 kilderkins, or 54 gals. 1 hogshead.
9 gallons	...	1 firkin.	2 hogsheads, or 108 gals. 1 butt.
2 firkins, or 18 gals.	...	1 kilderkin.	

NEW TABLE OF LIQUID MEASURE.

	TUN.	PIPES.	PUNS.	HHDS.	TIERCE	GAL.	POTL.	QTS.	PTS.
1 tun	1	2	3	4	6	252	504	1008	2016
1 pipe	$\frac{1}{2}$	1	...	...	...	...	...	...	...
1 pun	$\frac{2}{3}$	$\frac{2}{3}$	1	...	...	...	...	...	...
1 hhd	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	1	...	...	...	...	...
1 tierce	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{2}{3}$	1	...	...	...	...
36 gals	$\frac{1}{7}$	$\frac{2}{7}$	$\frac{3}{7}$	$\frac{4}{7}$	$\frac{6}{7}$	...	...	...	...
28 ,,	$\frac{1}{9}$	$\frac{2}{9}$	$\frac{1}{3}$	$\frac{4}{9}$	$\frac{2}{3}$	...	...	...	...
21 ,,	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{3}{4}$	$\frac{1}{3}$	$\frac{1}{2}$	...	...	...	...
18 ,,	$\frac{1}{14}$	$\frac{1}{7}$	$\frac{3}{14}$	$\frac{2}{7}$	$\frac{3}{7}$	...	...	...	...
14 ,,	$\frac{1}{18}$	$\frac{1}{9}$	$\frac{1}{6}$	$\frac{2}{9}$	$\frac{1}{3}$	...	...	...	...
12 ,,	$\frac{1}{21}$	$\frac{1}{24}$	$\frac{1}{7}$	$\frac{4}{21}$	$\frac{2}{7}$	...	...	...	...
9 ,,	$\frac{1}{28}$	$\frac{1}{14}$	$\frac{3}{28}$	$\frac{1}{7}$	$\frac{3}{14}$	...	...	...	...
7 ,,	$\frac{1}{36}$	$\frac{1}{18}$	$\frac{1}{12}$	$\frac{1}{9}$	$\frac{1}{6}$	...	...	...	...
6 ,,	$\frac{1}{42}$	$\frac{1}{21}$	$\frac{1}{14}$	$\frac{2}{21}$	$\frac{1}{7}$	...	...	...	...
4 ,,	$\frac{1}{63}$	$\frac{2}{63}$	$\frac{1}{21}$	$\frac{4}{63}$	$\frac{2}{21}$	...	...	...	...
3 ,,	$\frac{1}{84}$	$\frac{1}{42}$	$\frac{1}{28}$	$\frac{1}{21}$	$\frac{1}{14}$	...	...	...	...
2 ,,	$\frac{1}{126}$	$\frac{1}{63}$	$\frac{1}{42}$	$\frac{2}{63}$	$\frac{1}{21}$	...	...	...	...
4 ,,	$\frac{2}{252}$	$\frac{1}{126}$	$\frac{1}{84}$	$\frac{1}{63}$	$\frac{2}{42}$	...	...	...	...
1 pottle	$\frac{1}{504}$	$\frac{1}{252}$	$\frac{1}{168}$	$\frac{1}{126}$	$\frac{1}{84}$	$\frac{1}{2}$	...	...	...
1 quart	$\frac{1}{1008}$	$\frac{1}{504}$	$\frac{1}{336}$	$\frac{1}{252}$	$\frac{1}{168}$	$\frac{1}{4}$	$\frac{1}{2}$	...	...
1 pint	$\frac{1}{2016}$	$\frac{1}{1008}$	$\frac{1}{672}$	$\frac{1}{504}$	$\frac{1}{336}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	...
$\frac{1}{2}$ pint	$\frac{1}{4032}$	$\frac{1}{2016}$	$\frac{1}{1344}$	$\frac{1}{1008}$	$\frac{1}{672}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$
1 nog	$\frac{1}{8064}$	$\frac{1}{4032}$	$\frac{1}{2688}$	$\frac{1}{2016}$	$\frac{1}{1344}$	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{4}$

* A quarter of a pint is called a gill, or noggin; but in some parts half a pint is termed a gill, and a quarter pint is termed a jack.

† The old ale gallon contained 282 cubic inches.

‡ The quantity of a hogshead or pipe is various in different sorts of wine; thus:—A pipe of Claret, 126 gals.; ditto Madeira, 110 gals.; ditto Vidonia, 120 gals.; ditto Sherry, 130 gals.; ditto Port, 138 gals.; ditto Lisbon and Bucellas, 140 gals.

RULE.—Tuns multiplied by 4 are hogsheads; hogsheads by 63 are gallons; gallons by 4 are quarts; quarts by 2 are pints; pints divided by 2 are quarts; quarts by 4 are gallons; gallons by 63 are hogsheads; hogsheads by 4 are tuns.

EXAMPLES.

48.—How many pints are there in 3 hhds. 20 gals. 1 qt. ?—Ans. 1674 pts.
49.—In 1674 pints how many hogsheads ?—Ans. 3 hhds. 20 gals. 1 qt.
50.—In 63 hhds. how many pints ?—Ans. 31752 pints.
51.—Reduce 24 gallons 3 quarts to gills ?—Ans. 1792 gills.
52.—In 20 tuns 3 hhds. 50 gallons how many gallons ?—Ans. 5279 gallons.
53.—In 21 gallons, 2 quarts, 1 pint how many pints ?—Ans. 173 pints.

QUERY.—How are tuns brought to hogsheads; to gallons; to pints ?

DRY MEASURE.

2 pints	...	make	...	1 quart.	8 bushels	... make ...	1 quarter.
4 quarts	...	...	...	1 gallon.	4 quarters	... ...	1 chaldron.
2 gallons	...	...	...	1 peck.	10 quarters	... ..	1 last.
4 pecks	...	...	...	1 bushel.			

The old dry gallon contained 268 four-fifths cubic inches.
Coals are now sold by weight only.

EXAMPLES.

54.—In 24 gals. 2 qts. 1 pt. how many pints ?—Ans. 197 pints.
55.—In 4687 pints how many gallons ?—Ans. 585 gals. 3 qts. 1 pt.
56.—How many quarts in 1352 quarters, 5 bushels, 3 pecks, 1 gallon, 3 quarts ?—Ans. 346303 quarts.
57.—In 30720 quarts of corn how many quarters ?—Ans. 120 qrs.

FRENCH WEIGHTS AND MEASURES.

THE following tables give an example of the decimal system of weights and measures used in France; each increasing and diminishing in a tenfold proportion:—

LONG MEASURE.

			LENGTH IN ENGLISH.		
			Miles.	Yards.	Feet.	Inches.
10 Millimètres	are 1	Centimètre	...	...	...	0·39
10 Centimètres	1	Decimètre	...	...	...	3·93
10 Decimètres	1	Mètre	...	1	0	3·93
10 Mètres	1	Decamètre	...	10	2	9·7
10 Decamètres	1	Hectomètre	...	109	1	1·07
10 Hectomètres	1	Kilomètre	...	993	1	10·3
10 Kilomètres	1	Myriamètre	1	376	0	9·17

The Mètre is the unit of length, and is the ten millionth part of a line supposed to be drawn from the pole of the earth to the equator.

SQUARE MEASURE.

			SUPERFICES IN ENGLISH. Acres.	Roods.	Perches.	Yards.
10 Milliares are	1 Centiare	.....	...	...	...	1·19
10 Centiares	1 Deciare	.....	...	...	...	11·96
10 Deciares	1 Are	.....	...	...	3	28·85
10 Ares	1 Deca-are	.....	...	...	39	16·28
10 Deca-ares	1 Hectare	.....	2	1	35	11·58
10 Hectares	1 Kilare	.....	24	2	33	25·07

The Arè is the unit of square measure, and is equal to the square of one Decamètre. It is nearly the 40th part of an English acre.

LIQUID MEASURE.

			ENGLISH MEASURE. Gallons	Pints.
10 Millilitres are	1 Centilitre	... ...	... ...	0·0176
10 Centilitres	1 Decilitre	... ...	... ...	0·176
10 Decilitres	1 Litre	... ...	... ...	1·76
10 Litres	1 Decalitre	... ...	2	1·607
10 Decalitres	1 Hectolitre	... ...	22	0·077
10 Hectolitres	1 Kilolitre	... ...	220	0·774
10 Kilolitres	1 Myrialitre	... ...	2200	7·774

The Litre is the unit of capacity, or of the content of any vessel for holding liquids, &c. It is the cube of one decimètre. The standard unit of solids and aeriform fluids is the *stere* or *mètre cube*, equal to 35·316 English cube feet.

WEIGHT.

			ENGLISH WEIGHT. Oz. Avdp.	Oz. Troy.
10 Milligrammes are	1 Centigramme	... ...	·00035 ..	·00032
10 Centigrammes	1 Decigramme	... ...	·00352 ...	·00321
10 Decigrammes	1 Gramme	... ...	·03529 ...	·03217
10 Grammes	1 Decagrammes	.. ...	·35296 ...	·32171
10 Decagrammes	1 Hectogramme	... ...	3·52969 ...	3·21717
10 Hectogrammes	1 Kilogramme	... ...	35·29696 ...	32·17171

GEOMETRICAL MEASURE.

60 seconds″ ... make ... 1 minute.′ | 90 degrees ... make ... 1 quadrant.
60 minutes ... ... 1 degree.° | 360 deg., or 4 quadrants 1 circle.

In mathematical sciences, the calculations are founded on the division of the circle.

A degree of latitude or longitude on the equator, measures 69.07, or $69\frac{7}{10}$ British miles.

A nautical mile is one-sixtieth part, or a minute of a degree; six geographical miles are nearly equal to seven English miles.

The great circle of the Ecliptic or Zodiac, is divided in twelve signs, each containing thirty degrees.

THE SIX NORTHERN SIGNS.

SPRING SIGNS.	SUMMER SIGNS.
The Sun enters,—	*The Sun enters,—*
♈ *Aries*, the Ram, March 21.	♋ *Cancer*, the Crab, June 21.
♉ *Taurus*, the Bull, April 19.	♌ *Leo*, the Lion, July 23.
♊ *Gemini*, the Twins, May 21.	♍ *Virgo*, the Virgin, August 23.

THE SIX SOUTHERN SIGNS.

AUTUMNAL SIGNS.	WINTER SIGNS.
The Sun enters,—	*The Sun enters,—*
♎ *Libra*, the Balance, Sept. 23.	♑ *Capricornus*, the Goat, Dec. 21.
♏ *Scorpio*, the Scorpion, Oct. 23.	♒ *Aquarius*, Water-bearer, Jan. 19.
♐ *Sagittarius*, the Archer, Nov. 21.	♓ *Pisces*, the Fishes, Feb. 18.

"The ram, the bull, the heavenly twins,
And next the crab the lion shines;
The virgin and the scales,
The scorpion, archer, and sea-goat,
The man that holds the water-pot,
And fish with glittering tails."

The progress of the sun through these signs causes the variation in the length of days, and the consequent vicissitudes of the seasons. Spring commences at the Vernal Equinox (March 21), when the sun enters Aries; Summer, at the Summer Solstice (June 21), when he enters Cancer; Autumn, at the Autumnal Equinox (September 23), when he enters Libra; and Winter, at the Winter Solstice (December 21), when he enters Capricorn.

The longest day is that of the Summer Solstice, and the shortest that of the Winter Solstice. At the Equinoxes, the day and night are everywhere equal.

☉ *Sol*, the Sun, the centre of the solar system.

☽ *Luna*, the Moon, a secondary planet, attending the earth.

WANDERING STARS, CALLED PLANETS.

☿ Mercury, ♀ Venus. ⊕ The Earth. ♂ Mars.
♃ Jupiter. ♄ Saturn. ♅ Herschel.

TIME TABLE.

60 seconds *(sec.)*	make	1 minute, *min.*
60 minutes, or 3600 seconds		1 hour, *hr.*
24 hours, or 1440 minutes		1 day, *d.*
7 days, or 168 hours		1 week, *wk.*
4 weeks or 28 days		1 lunar month, *m.*
28, 29, 30, or 31 days		1 calendar month.
52 wks., 1 day, 6 hrs.; or 365 days 6 hrs.; or 8766 hrs.		1 Julian year, *yr.*
365 days, 5 hours, 48 minutes, 51½ seconds		1 solar year.
12 calendar months, or 13 lunar		1 year.
100 years		1 century.

QUARTERLY TERMS.

In England.	*In Scotland.*
Lady Day, March 25th.	Candlemas, February 2nd.
Midsummer, June 24th.	Whitsuntide, May 15th.
Michaelmas, September 29th.	Lammas, August 1st.
Christmas, December 25th.	Martinmas, November 11th.

To know the days in each month, observe—

The days are thirty in September,
April, June, and November;
Twenty-eight in February alone;
In each other thirty-one;
But in every leap year* you'll find
February counts twenty-nine.

EXAMPLES.

58.—In 72015 hours, how many weeks?—Ans. 428 weeks, 4 days, 15 hours.
59.—How many hours are there in 428 weeks, 4 days, 15 hours?—Ans. 72015 hours.
60.—A clock strikes 156 times a day; how many strokes in 6 years?—Ans. 341640.
61.—How many minutes has a boy lived who is 10 years and 6 weeks old?—Ans. 5316480 minutes.
62.—How many years and days is it since the Battle of Waterloo, which was gained on the 18th of June, 1815, it being now the first of May, 1854?—Ans. 38 years, 196 days.
63.—In 365 days, how many minutes?—Ans. 525600 minutes.
64.—In 16 yrs., 5 mon., 2 weeks, how many seconds?—516499200 seconds.
65.—Bring 72468573 minutes to years?—Ans. 37 years, 320 days, 9 hours, 33 minutes.

QUERIES.—How many minutes in an hour? How many hours in a day? How many days in a week? How many weeks in a year? How would you bring years to minutes, and days to years?

* The leap year is found by dividing by 4: if even, it is leap year; if odd, so many after leap year.

STANDARD WEIGHTS OF THE PRESENT COINS.

	dwt.	grs.
Sovereign	5	$3\frac{1}{8}\frac{7}{2}\frac{1}{3}$
Half ditto	1	$13\frac{3}{8}\frac{8}{2}\frac{7}{3}$
Crown	18	$4\frac{4}{11}$
Half ditto	9	$2\frac{8}{11}$
Shilling...	3	$15\frac{8}{11}$

	dwt.	grs.
Sixpence...	1	$19\frac{7}{11}$
Fourpence	1	$5\frac{1}{11}$

Copper 24d. to the pound avoirdupois.

NOTE.—The mint price of gold is £3 17s. 10½d. per ounce; of silver, 5s. 6d. per ounce. Any sum in silver over 40s. is not a legal tender; and any sum in copper over 12d. is not a legal payment.

ADDITION OF MONEY.

NEW TABLE.

	of £1.	of 10s.	of 6s.8d.	of 5s.	of 3s.4d.	of 2s.6d.	of 2s.	of 1s.8d.	of 1s.0d.	of 10d.
10s. 0d.	$\frac{1}{2}$	...	...	...	...	...	...	...	...	...
6 8	$\frac{1}{3}$	...	...	...	...	...	...	...	...	...
5 0	$\frac{1}{4}$	$\frac{1}{2}$	...	...	...	...	...	...	...	...
3 4	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{2}$	...	...	...	...	...	...	...
2 6	$\frac{1}{8}$	$\frac{1}{4}$	...	$\frac{1}{2}$	...	...	...	...	...	...
2 0	$\frac{1}{10}$	$\frac{1}{5}$	...	...	...	...	...	...	...	...
1 8	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$	...	...	...	...	...
1 4	$\frac{1}{15}$	...	$\frac{1}{5}$	...	...	...	...	...	...	...
1 3	$\frac{1}{16}$	$\frac{1}{8}$	...	$\frac{1}{4}$	...	$\frac{1}{2}$	...	...	...	...
1 0	$\frac{1}{20}$	$\frac{1}{10}$	...	$\frac{1}{5}$	...	...	$\frac{1}{2}$	...	...	...
0 10	$\frac{1}{24}$	$\frac{1}{12}$	$\frac{1}{8}$	$\frac{1}{6}$	$\frac{1}{4}$	$\frac{1}{3}$	...	$\frac{1}{2}$	...	...
0 8	$\frac{1}{30}$	$\frac{1}{15}$	$\frac{1}{10}$	...	$\frac{1}{5}$	...	$\frac{1}{3}$	...	...	...
0 7½	$\frac{1}{32}$	$\frac{1}{16}$	...	$\frac{1}{8}$	...	$\frac{1}{4}$	...	...	...	...
0 6	$\frac{1}{40}$	$\frac{1}{20}$	...	$\frac{1}{10}$	...	$\frac{1}{5}$	$\frac{1}{4}$	...	$\frac{1}{2}$	...
0 5	$\frac{1}{48}$	$\frac{1}{24}$	$\frac{1}{16}$	$\frac{1}{12}$	$\frac{1}{8}$	$\frac{1}{6}$	...	$\frac{1}{4}$	...	$\frac{1}{2}$
0 4	$\frac{1}{60}$	$\frac{1}{30}$	$\frac{1}{20}$	$\frac{1}{15}$	$\frac{1}{10}$	...	$\frac{1}{6}$	$\frac{1}{5}$	$\frac{1}{3}$	...
0 3	$\frac{1}{80}$	$\frac{1}{40}$	...	$\frac{1}{20}$	...	$\frac{1}{10}$	$\frac{1}{8}$	...	$\frac{1}{4}$	...
0 2	$\frac{1}{120}$	$\frac{1}{60}$	$\frac{1}{40}$	$\frac{1}{30}$	$\frac{1}{20}$	$\frac{1}{15}$	$\frac{1}{12}$	$\frac{1}{10}$	$\frac{1}{6}$	$\frac{1}{5}$
0 1	$\frac{1}{240}$	$\frac{1}{120}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{40}$	$\frac{1}{30}$	$\frac{1}{24}$	$\frac{1}{20}$	$\frac{1}{12}$	$\frac{1}{10}$
0 0½	$\frac{1}{480}$	$\frac{1}{240}$	$\frac{1}{160}$	$\frac{1}{120}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{48}$	$\frac{1}{40}$	$\frac{1}{24}$	$\frac{1}{20}$
0 0¼	$\frac{1}{960}$	$\frac{1}{480}$	$\frac{1}{320}$	$\frac{1}{240}$	$\frac{1}{160}$	$\frac{1}{120}$	$\frac{1}{96}$	$\frac{1}{80}$	$\frac{1}{48}$	$\frac{1}{40}$

RULE.—For 4 in farthings carry 1 to the pence; for 12 in pence 1 to the shillings; for 20 in shillings 1 to the pounds; and 1 for every 10 in the pounds, as in simple addition.

Reason.—Four farthings make 1d. in the place of pence; 12 pence 1s. in the line of shillings; and 20s. £1 in the place of pounds; and add the pounds as whole numbers.

EXAMPLES.

1.—£	s.	d.	2.—£	s.	d.
7168	17	4¾	1313	16	5¾
3133	14	11¼	1927	11	10¼
3171	19	10¾	3168	16	5¼
Ans. 14954	6	9¼	Ans. 10178	16	6
13474	12	2¾	6410	4	9½
Proof. 14954	6	9¼	Proof. 10178	16	6

3.—£	s.	d.	4.—£	s.	d.	5.—£	s.	d.
57	16	3½	97	18	3½	56	16	9½
42	13	9½	84	16	9¼	47	16	3¾
33	17	6¼	73	17	5¾	83	13	9¼
53	18	8½	64	13	5½	62	17	5½
76	16	10¾	53	18	6½	48	13	9½
84	17	6½	63	19	7¾	65	15	10½
Ans.			Ans.			Ans.		

In page 28 we introduced a new system of simple addition for practice on the blackboard, (in order to save trouble to teachers in large schools), by which they can see at one view the answer of any question without the trouble of adding the sum over again. On the same principle, we here lay down a new system for compound addition, which may be made applicable in all cases, no matter what the denomination.

RULE.—Put the first line down at pleasure, but have the second line to correspond with the first, so that in the pence the two figures in units' place make 12. In the line of shillings, the next two figures to make 20, with the carried figures from the pence, and in the line of pounds, that each two figures make 10. The key line may be set down at top, bottom, or in the middle of the question, which will be the answer.

6.—£	s.	d.	7.—£	s.	d.		8.—£	s.	d.	
6	7	9	13	11	11	K.L.	24	7	6	
3	12	3	8	7	6		75	12	6	
7	6	5	1	12	6		53	18	9	
2	13	7	3	13	7		46	1	3	
6	9	8	6	6	5		34	17	6	K.L.
3	10	4	9	12	10		56	16	4	
5	9	2	0	7	2	K.L.	43	3	8	
Ans. 35	9	2	Ans. 43	11	11		Ans. 334	17	6	

APPLICATION.

9.—I owe Messrs. J. & J. Potter and Co., merchants, Manchester, as follows, viz.:—For calico, £13 10.; silk, £17 13s. 5d.; cotton, £208 17s.; chintz, £86 0s. 9d.; a former account £300; selicia, £15 17s. 3¾d.; broad cloth, £30 10s. 4½d.; what do I owe them in all?—Ans. £672 8s. 10½d.

10.—Bought of Messrs. Bannerman & Sons., York-street Manchester, goods to the amount of £1468 16s. 7d.; paid freight, £27 7s. 6d.; other charges, £23 14s. 7½d.; I sold them immediately for £1668 17s. 6½d.; what sum did I gain?—Ans. £148 18s. 10d.

11.—Bought of Messrs. Henry and Co., Potter-street, Manchester, 20 pieces of black silk @ £3 1s. 9d. per piece; 30 dozen silk handkerchiefs @ £1 16s. 3d. per dozen; 24 pieces of India chintz @ £2 8s. 5d. per piece: 28 pieces of prints @ £1 9s. 7d. per piece; and 60 pieces of fine muslin @ £1 5s. 6d. per piece; paid cash £209 10s. 11d.; what remains due?—Ans. £82 11s. 11d.

TROY WEIGHT.

RULE.—For 24 grains, carry 1 to the pennyweights; for 20 pennyweights, 1 to the ounces; for 12 ounces, 1 to the lbs.; and 1 for every 10 in the lbs., as in simple addition.

EXAMPLES.

	lb.	oz.	dwts.	gr.
12.—	4712	11	19	17
	3714	10	17	15
	9713	11	13	17
	3174	10	17	12
Ans.				

	lb.	oz.	dwts.	gr.
13.—	163	10	15	13
	971	11	14	16
	316	10	13	17
	941	10	11	13
Ans.				

	lb.	oz.	dwts.	gr.
14.—	4763	9	13	17
	5236	11	19	6
	4273	7	13	13
	3412	5	12	14
Ans.				

APPLICATION.

15.—Bought of Messrs. Hunt and Roskell, gold and silversmiths, Exchange Buildings, Manchester, 3 dozen of silver spoons, weighing 5 lbs. 9 oz. 8 dwts.; a teapot, weighing 3 lbs. 2 oz. 16 dwts. 16 grains; two salvers, weighing 4 lbs. 6 oz. 17 dwts.; a dozen silver forks, weighing 1 lb. 8 oz. 19 dwts. 22 grs.; what was the weight of all these articles?—Ans. 15 lbs. 4 oz. 1 dwt. 14 grs.

16.—Milner Gibson, Esq., M.P., has a service of plate in which there are 20 dishes, weighing 203 oz. 8 dwts.; 36 plates, weighing 408 oz. 9 dwts.; 5 dozen spoons, weighing 112 oz. 8 dwts.; 12 salts, weighing 71 oz. 7 dwts.; knives and forks, weighing 73 oz. 5 dwts.; two large cups and a tankard, weighing 121 oz. 7 dwts.; with sundry articles, weighing 105 oz. 5 dwts.; what was the weight of the whole?—Ans. 91 lbs. 3 oz. 9 dwts.

QUERIES.—How do you bring grains to lbs.? lbs. to grains? Prove addition.

AVOIRDUPOIS WEIGHT.

RULE.—For 16 drachms carry 1 to the ounces; for 16 ounces, 1 to the lbs.; for 28 lbs. 1 to the quarters; for 4 quarters, 1 to the cwts.; for 20 cwts. 1 to the tuns; and the tuns as in simple addition.

EXAMPLES.

	tuns.	cwt.	qr.	lb.
17.—	3746	17	3	14
	1373	14	1	17
	1468	13	3	15
	1313	11	1	19
Ans.				

	cwt.	qr.	lb.
18.—	134	3	17
	131	2	18
	147	1	17
	914	2	17
Ans.			

	lb.	oz.	dr.
19.—	1376	11	15
	1314	10	11
	3715	11	14
	1123	10	14
Ans.			

APPLICATION.

20.—Bought 5 bags of hops: the first weighed 4 cwts. 3 qrs. 13 lbs.; the second, 2 cwts. 2 qrs. 11 lbs.; the third, 2 cwts. 3 qrs. 5 lbs.; the fourth, 2 cwts. 3 qrs. 12 lbs.; the fifth, 2 cwts. 3 qrs. 15 lbs.; what was the weight of the whole?—Ans. 16 cwts.

21.—Bought of Mr. Binyon, grocer and tea merchant, St. Ann's Square, Manchester, 6 hhds. of sugar: the first weighed 5 cwts. 3 qrs. 27 lbs.; the second, 4 cwts. 1 qrs. 19 lbs.; the third, 6 cwts. 2 qrs. 20 lbs.; the fourth, 3 cwts. 3 qrs. 22 lbs.; the fifth, 7 cwts. 1 qr. 11 lbs.; and the sixth, 4 cwts. 3 qrs. 17 lbs.; what was the weight of all?—Ans. 33 cwts. 1 qr. 4 lbs.

CHEMISTS' WEIGHTS.

RULE.—For 3 in scruples, carry 1 to the drachms; for 8 in drachms, 1 to the ounces; for 12 in ounces, 1 to the lbs.; and the lbs. as in simple addition.

EXAMPLES.

	lb.	oz.	dr.	sc.
22.—	174	10	7	1
	19	11	5	1
	11	10	6	2
	9	6	1	1
	4	5	4	1
	14	1	3	2
Ans.				

	lb.	oz.	dr.	sc.
23.—	11	11	5	1
	12	11	4	2
	17	10	5	1
	13	11	6	2
	17	10	5	1
	12	11	4	1
Ans.				

	lb.	oz.	dr.	sc.
24.—	19	11	4	1
	14	10	5	2
	14	11	2	1
	14	10	7	1
	17	8	5	2
	18	4	4	1
Ans.				

APPLICATION.

25.—Mr. Westmacott, chemist, Manchester, mixed 5 ingredients: the first weighed 13 lbs. 7 oz.; the second, 11 oz. 7 drs. 1 scr.; the third, 7 lbs. 0 drs. 2 scrs.; the fourth, 11 lbs. 3 drs. 1 scr.; the fifth, 15 lbs. 5 oz. 2 scrs.; what was the weight in all?—Ans. 48 lbs. 0 oz. 4 drs.

QUERIES.—What do you carry from the grains, scruples, drachms, and ounces?

LIQUID MEASURE.

RULE.—For 4 gills carry 1 to the pints; for 2 pints, 1 to the quarts; for 4 quarts, 1 to the gallons; for 63 gallons, 1 to the hogsheads; for 4 hogsheads, 1 to the tuns; and the tuns as in simple addition.

EXAMPLES.

	26.					27.						28.					
	hhd.	gal.	qt.	pt.	g.	tun.	hhd.	gal.	qt.	pt.	g.	tun.	hhd.	gal.	qt.	pt.	g
	31	57	2	1	1	37	3	27	2	1	1	39	2	14	1	1	3
	19	17	3	1	3	17	2	60	1	1	3	40	1	57	3	1	2
	17	39	2	1	1	39	1	59	1	1	1	99	1	53	2	1	3
Ans.						Ans.						Ans.					

APPLICATION.

29.—Bought of Mr. William Magee, spirit merchant, Salford, 3 casks of Irish whiskey: the first contained 44 gals. 8 qts. 1 pt. 3 gills; the second, 37 gals. 2 qts. 3 gills; and the third, 61 gals. 3 qts. 1 pt. 2 gills; what did the whole contain?—Ans. 145 gals. 3 qts.

NOTE.—One gallon of water weighs 10 lbs. avoirdupois; a pint, 1¼ lb.; and a bushel, 80 lbs. The spirit merchant will find, at the end of this work, tables constructed, by which he can measure with the common inch rule, casks from 10 to 130 gallons, whether the cask be lying on its side or standing upright.

Repeat the rule for Liquid Measure.

DRY MEASURE.

RULE.—For 2 pints, carry 1 to the quarts; for 4 quarts, 1 to the gallons; for 2 gallons, 1 to the pecks; for 4 pecks, 1 to the bushels; and for 8 bushels, 1 to the quarters; and the quarters as in simple addition.

	qrs.	b.	p.	g.		b.	p.	g.	q.	p.		b.	p.	g.	q.	p.
30.—	37	1	3	3	31.—	27	3	1	1	1	32.—	31	2	1	1	0
	60	1	1	2		26	2	0	0	0		17	1	1	1	0
	14	0	2	3		23	3	1	0	1		20	1	1	1	0
Ans.					Ans.						Ans.					

APPLICATION.

33.—Messrs. Losh, Wilson, & Bell, merchants, Newcastle-on-Tyne, consigned to their correspondent at Hamburgh, on the 2nd of January, 1854, 27 qrs. 6 bs. 3 p. of wheat; on the 10th, 38 qrs. 4 bs. 2 p.; on the 14th, 49 qrs. 6 bs.; and on the 20th of the same month, 58 qrs. 7 bs. 3 p.; how much did they export during the month?—Ans. 175 qrs. 1 bs. 0 p.

Repeat the rule for Dry Measure.

CLOTH MEASURE.

RULE.—For every 4 nails, carry 1 to the quarters; for every 4 quarters, 1 to the yards; for every 5 quarters, 1 to the ells English; and for every 6 quarters, 1 to the ells French.

EXAMPLES.

	yds.	qr.	ns.		yds.	qr.	ns.		e. E.	qr.	ns.		e. E.	qr.	ns.
34.—	36	3	1	35.—	374	1	2	36.—	421	2	2	37.—	312	2	2
	37	1	1		387	2	3		123	1	3		123	2	6
	14	1	2		462	3	1		210	2	3		314	1	2
Ans.				Ans.				Ans.				Ans.			

APPLICATION.

38.—Bought of Messrs. Kendal, Milne, and Faulkner, silk merchants, Manchester, seven pieces of silk: the first contained 72 yds. 1 qr. 2 ns.; the second 20 yds. 3 ns.; the third, 100 yards; the fourth, 36 yds. 3 ns.; the fifth, 46 yds. 2 ns.; the sixth, 71 yds. 2 qrs. 1 n.; and the seventh, 46 yds. 1 qr. 2 n.; how many yards were there in all?—Ans. 392 yds. 3 qr. 1 n.

Repeat the rule for Cloth Measure.

LONG MEASURE.

RULE.—For 3 barleycorns, carry 1 to the inches; for 12 inches, 1 to the feet; for 3 feet, 1 to the yards; for 5½ yards, 1 to the poles English; for 7 yards, 1 to the perches Irish; for 40 poles, carry 1 to the furlongs; for 8 furlongs, 1 to the miles.

EXAMPLES.

	ml.	fur.	per.		ml.	fur.	per.		ml.	fur.	per.		ml.	fur.	yds.
39.—	27	5	37	40.—	176	1	6	41.—	4	6	20	42.—	177	7	6
	19	6	33		178	2	8		9	5	13		197	6	5
	14	7	19		197	2	10		7	4	9		189	5	6
Ans.				Ans.				Ans.				Ans.			

APPLICATION.

43.—James rode 35 mls. 2 fur. 34 per. on Monday; Joseph walked 24 mls. 6 fur. 25 per. 2 yds. on Tuesday; he rode, on Wednesday, 42 mls. 7 fur. 4 yds.; he walked, on Thursday, 15 mls. 4 fur. 38 per. 3 yds.; what distance did they travel in the four days?—Ans. 118 mls. 5 fur. 18 per. 1 $\frac{7}{11}$ yds.

Repeat the rule for Long Measure.

SOLID MEASURE.

RULE.—For every 1728 cubic inches, carry 1 to the feet; for every 27 cubic feet, 1 to the yards; and for every 166⅔ cubic yards, 1 to the perches; and perches as in simple addition.

EXAMPLES.

44.				45.				46.			
per.	yds.	ft.	in.	per.	yds.	ft.	in.	per.	yds.	ft.	in.
374	130	14	150	176	126	23	1711	312	19	17	13
371	176	24	140	314	141	17	1214	164	26	23	14
914	68	28	13	431	19	24	1711	726	17	11	18
Ans.				Ans.				Ans.			

Repeat the rule for Solid Measure.

SQUARE OR LAND MEASURE.

RULE.—For every 144 square inches, carry 1 to the square feet; for every 9 square feet, 1 to the square yards; for every 49 square yards, 1 to the square perches or poles; for every 40 square perches or poles, 1 to the square acres, and the acres as in simple addition.

NOTE.—The statute pole is 5½ yards, but differs in various localities. In Lancashire, 7 yards make a pole or perch; in Cheshire, 8 yards: 4840 square yards are one statute acre.

EXAMPLES.

	a.	r.	p.	yds.	ft.	in.		a.	r.	p.	yds.	ft.	in.
47.—	147	1	27	23	7	78	48.—	2376	3	16	12	2	140
	192	2	16	38	4	101		1242	3	32	17	7	111
	141	3	39	16	6	140		1723	2	18	32	6	78
Ans.							Ans.						

Repeat the rule for Land or Square Measure.

TIME.

RULE.—For 60 seconds carry 1 to the minutes; for 60 minutes 1 to the hours; for 24 hours 1 to the days; for 7 days 1 to the weeks; for 4 weeks 1 to the months; for 12 months 1 to the years; and add the years as in simple addition.

EXAMPLES.

	w.	d.	h.	m.	s.		degs.	′	″	‴	⁗
49.—	27	4	18	37	56	50.—	176	30	50	41	25
	37	6	19	50	51		195	21	47	46	21
	31	4	18	51	40		197	5	43	51	27
Ans.						Ans.					

Repeat the rule for Time.

COMPOUND SUBTRACTION

Teaches to find the difference between two numbers of different denominations.

RULE.—Place the lesser number under the greater. If the lower farthings be greater, borrow from 4, and carry 1 to the pence; when the lower pence are higher, borrow from 12, and carry 1 to the shillings; when the lower shillings are higher, borrow from 20, carry 1 to the pounds, and the pounds as in simple subtraction. The method of proof is the same as in simple subtraction.

EXAMPLES IN COINS.

	1.			2.			3.			4.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
From	12	13	6¼	19	17	4¾	135	17	4½	176	13	10¼
Take	11	7	4¼	11	10	2¼	94	16	1¾	57	18	6¾
Ans.												

TROY WEIGHT.

RULE.—When the lower grains are greater, borrow from 24, adding the remainder to the upper, and carry 1 to the dwts.; when the lower dwts. are greater borrow from 20, adding 1 to the ounces: when the lower ounces are greater borrow from 12, and carry 1 to the lbs.; and subtract the lbs. as in simple subtraction.

EXAMPLES.

	lb.	oz.	dwt.	gr.		lb.	oz.	dwt.	gr.		lb.	oz.	dwt.	gr.
5.—From	5	6	13	14	6.—From	347	11	12	6	7.—From	197	11	13	13
Take	3	4	6	8	Take	279	10	17	8	Take	178	10	17	10
Ans.					Ans.					Ans.				

Repeat the rule for subtracting Troy Weight.

AVOIRDUPOIS WEIGHT.

RULE.—When the lower drs. are greater, borrow from 16; when the lower ounces are greater, borrow from 16; when the lower lbs. are greater, borrow from 28; when the lower qrs. are greater borrow from 4; when the lower cwts. are greater, borrow from 20; observing, in each case, to add the remainder to the upper number, and the tons as in simple subtraction.

EXAMPLES.

	8.					9.						10.					
	cwt.	qr.	lb.	oz.	dr.	t.	cwt.	qr.	lb.	oz.	dr.	t.	cwt.	qr.	lb.	oz.	dr.
From	16	3	14	6	14	16	16	2	14	13	13	23	17	3	19	12	12
Take	12	1	8	4	8	12	18	3	19	15	15	17	18	3	23	13	13
Ans.						Ans.						Ans.					

Repeat the rule for Avoirdupois Weight.

CHEMISTS' WEIGHT.

RULE.—When the lower grs. are greater, borrow from 20; when the lower scruples are greater, borrow from 3; when the lower drachms are greater, borrow from 8; when the lower ounces are greater, borrow from 12; and the lbs. as in simple subtraction.

EXAMPLES.

	11.					12.					13.				
	lb.	oz.	dr.	scr.	gr.	lb.	oz.	dr.	scr.	gr.	lb.	oz.	dr.	scr.	gr.
From	19	8	7	2	19	24	6	5	1	16	27	5	6	1	17
Take	15	5	5	1	16	19	8	7	2	19	23	7	7	1	10
Ans.						Ans.					Ans.				

Repeat the rule for Chemists' Weight.

LIQUID MEASURE.

RULE.—When the lower pints are greater, borrow from 2; when the lower quarts are greater, borrow from 4; when the lower gallons are greater, borrow from 63; when the lower hogsheads are greater, borrow from 4; and the tuns as in simple subtraction.

EXAMPLES.

	14.					15.					16.				
	t.	hhd.	g.	q.	p.	t.	hhd.	g.	q.	p.	t.	hhd.	g.	q.	p.
From	140	3	56	2	1	163	2	56	1	0	176	3	23	1	1
Take	131	2	50	1	1	94	3	61	1	1	100	3	39	1	1
Ans.						Ans.					Ans.				

Repeat the rule for subtracting Liquids.

DRY MEASURE.

RULE.—When the lower pints are greater borrow from 2, carry 1 to the quarts; when the lower quarts are greater borrow from 4, carry 1 to the gallons; when the lower gallons are greater borrow from 2, carry 1 to the pecks; when the lower pecks are greater borrow from 4, carry 1 to the bushels; when the lower bushels are greater, borrow from 8, and carry 1 to the quarters.

EXAMPLES.

	17.					18.						19.					
	qrs.	b.	p.	g.	q.	p.	qrs.	b.	p.	g.	q.	p.	qrs.	b.	p.	g.	q.	p.
From	136	7	3	1	3	1	204	6	2	0	2	0	311	6	3	1	3	1
Take	52	2	1	0	2	0	19	6	3	1	1	1	204	7	2	1	1	1
Ans.							Ans.						Ans.					

Repeat the rule for subtracting Dry Measure.

SQUARE OR LAND MEASURE.

RULE.—When the lower feet exceed the upper, borrow from 9, and carry 1 to the yards; when the lower yards are greater, borrow from 49, and carry 1 to the poles or perches; when the poles in the lower line exceed the upper, borrow from 40, and carry 1 to the roods; when the roods in the lower line are greater, borrow from 4, and carry 1 to the acres; and the acres as in simple subtraction.

EXAMPLES.

	a.	r.	p.	y.	f.		a.	r.	p.	y.	f.
20.—From	100	2	36	16	7	21.—From	114	1	21	15	16
Take	97	1	30	14	5	Take	74	2	36	16	0
Ans.						Ans.					

CLOTH MEASURE.

RULE.—In the nails, borrow from 4, and carry 1 to the quarters; in the quarters, borrow from 4, and carry 1 to the yards, and the yards as in whole numbers. In such cases add the remainder to the upper number.

EXAMPLES.

	e.E.	yd.	qr.	n.		yd.	qr.	n.		e.E.	yd.	qr.	n.
22.—From	73	2	1	2	23.—From	96	1	1	24.—From	127	1	2	1
Take	29	0	1	0	Take	48	2	2	Take	67	2	2	3
Ans.					Ans.				Ans.				

LONG MEASURE.

RULE.—In the barleycorns, borrow from 3, and carry 1 to the inches; in the inches, borrow from 12, and carry 1 to the feet; in the feet, borrow from 3, and carry 1 to the yards; in the yards, borrow from 7 Irish, and from 5½ English, and carry 1 to the perches; in the perches, borrow from 40, and carry 1 to the furlongs; in the furlongs, borrow from 8, and carry 1 to the miles.

EXAMPLES.

	m.	f.	p.	y.
25.—From	19	3	36	3
Take	12	5	38	2
Ans.				

	m.	f.	p.	y.
26.—From	212	2	10	2
Take	111	1	11	1
Ans.				

	m.	f.	p.	y.
27.—From	116	6	5	3
Take	110	7	3	4
Ans.				

TIME.

RULE.—In the seconds, borrow from 60, and carry 1 to the minutes; in the minutes, borrow from 60, and carry 1 to the hours; in the hours, borrow from 24, and carry 1 to the days; in the days, borrow from 7, and carry 1 to the weeks; in the weeks, borrow from 4, and carry 1 to the months; in the months, borrow from 12, and carry 1 to the years; and the years as in simple subtraction.

EXAMPLES.

28.

	y.	m.	w.	d.
From	1741	8	2	3
Take	1532	9	3	5
Ans.				

29.

	y.	m.	w.	d.	h.	m.	s.
From	6542	6	3	5	13	40	20
Take	4765	9	3	6	18	54	37
Ans.							

30.

	y.	m.	w.	d.	h.	m.	s.
From	56	7	3	4	9	20	19
Take	37	9	1	6	10	38	21
Ans.							

A NEW TABLE, SHOWING THE NUMBER OF DAYS BETWEEN ANY TWO GIVEN TIMES.

PROBLEM.—To find the number of days from the 1st of January to the 11th of July.

RULE.—To the right hand of July you will find 181 days, to which add the 11 days of July, and you have 192, the number of days required.

31.—How many days from the 9th of May to the 17th of September?—Opposite May in the column you will find 120, to which add 9 = 129; opposite September you will find 243, to which add 17 = 260; then from 260 take 129: the remainder will be 131,—the number of days sought.

DAYS.		MONTHS.	DAYS.	
31	334	January ...	00	31
59	306	February .	31	28
90	275	March	59	31
120	245	April	90	30
151	214	May	120	31
181	184	June	151	30
212	150	July	181	31
243	122	August ...	212	31
273	92	September	243	30
304	61	October ...	273	31
334	31	November.	304	30
365	00	December.	334	31

32.—How many days from the 5th of November, 1846, to the 16th of May, 1847?—Add 25, complement of 5 to 30 (days in November), to 31 found on the left hand of November, and to that sum add 120 found opposite May—more 16 for May, and you have 192, the days required.

To ascertain the length of Day and Night at any time of the Year.

RULE.—Double the time of the sun's rising, which gives the length of the night, and double the time of setting, which gives the length of the day.

EXAMPLE.

33.—The Prince of Wales was born on the 9th of November, 1841; what was the length of the day and night—the sun rose at 7.10, and set at 4.70?

Sun set	4.70	rose	7.10	Day	9.40	
	2		2	Night	14.20	
Length of day	9.40	Length of night	14.20	Proof	24.0	hours.

COMPOUND MULTIPLICATION

TEACHES to find the product of any number of divers denominations repeated a number of times.

RULE.—Begin to multiply the lowest denomination by the quantity, and reduce it to the next higher; carry as many of the higher as it contains to the next, and so proceed from one denomination to another.

CASE 1.

EXAMPLES.

	1.			2.			3.		
	£	s.	d.	£	s.	d.	£	s.	d.
	1	12	6½	13	12	9¾	14	13	7¼
2 yds. at			per yd.			by 9			by 7
			2			9			7
Ans.	3	5	1	122	15	3¾	102	15	2¾

4.—4 yards of cloth, at 17s. 6½d. per yard?—Ans. £3 10s. 2d.
5.—5 cwt. of sugar, at £3 0s. 6d. per cwt?—Ans. £15 2s. 6d.
6.—7 yards of linen, at 7s. 10d. per yard?—Ans. £2 14s. 10d.

CASE 2.

RULE.—If the number be composite, multiply the price by one of the components, and that product by the other, and you will have the amount.

EXAMPLES.

7.—16 cwt. of Russian tallow, at £1 18s. 8d. per cwt.?
× £1 18s. 8d. by 4=£7 14s. 8d. × by 4 ... ... =£30 18s. 8d. Ans.
8.—14 cwt., at 6s. 7¾d. per cwt.?
× 6s. 7¾d. by 2=13s. 3½d. × by 7 ... ... =£4 13s. 0¼d. Ans.
9.—72 cwt., at 15s. 9d. per cwt.?—Ans. £56 14s.
10.—96 cwt., at 1s. 10¾d. per cwt.?—Ans. £9 2s.

CASE 3.

If the quantity be not a Composite Number.

RULE.—Multiply the nearest composite you can find: if more, subtract; but if less, add so many times the price of one for the amount.

EXAMPLES.

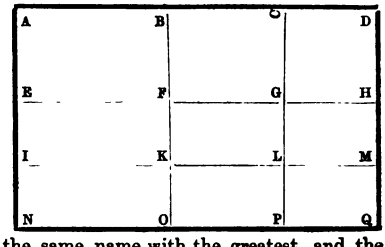
11.—75 yards, at 6s. 9¾d. × by 9=£3 1s. 3¾d. × by 8=£24 10s. 6d. + £1 0s. 5¼d. for 3 yards=£25 10s. 11¼d. Ans.
12.—46 yards, at 4s. 7¼d. per yard?—Ans. £10 11s. 9½d.
13.—79 yards, at 7s. 10d. per yard?—Ans. £30 18s. 10d.

MULTIPLICATION OF WEIGHTS AND MEASURES.

EXAMPLES.

14.—Multiply 14 lbs. 10 ozs. 0 dwts. 21 grs. by 4?—Ans. 59 lbs. 4 ozs. 3 dwts. 12 grs.
15.—Multiply 17 tons 17 cwts. 0 qrs. 24 lbs. by 2?—Ans. 35 tons 14 cwts. 1 qr. 20 lbs.
16.—Multiply 14 cwts. 0 qrs. 21 lbs. 0 ozs. 14 drs. by 7?—Ans. 99 cwts. 1 qr. 7 lbs. 6 ozs. 2 drs.
17.—Multiply 10 lbs. 6 ozs. 4 drs. 1 sc. 17 grs. by 9?—Ans. 94 lbs. 11 ozs. 1 dr. 1 sc. 13 grs.
18.—Multiply 127 yds. 0 qrs. 3 n. by 12?—Ans. 1526 yds. 1 qr.

A new Diagram, illustrating the principles of all duodecimal multiplication, which will prove the multiplication of pounds, shillings, and pence, by the same; cwts., qrs., and lbs., by the same; feet, inches, and parts, by the same, &c., &c.



1.—Let there be two numbers of three denominations given, and let A F be the square or the rectangle, made of the greatest denomination in both numbers; E K and B G, two rectangles, made by multiplying the 1st denomination by the 2nd; the product divided by the integer of the greatest denomination reduced into the parts of the 2nd; the quotient shall be of the same name with the greatest, and the remainder of the same name with the 2nd.

2.—F L is the square of the 2nd denomination; which, being divided by an integer of the greatest, reduced into the parts of the 2nd, the quotient shall be of the same denomination as the 2nd; and if there be a remainder, it must be multiplied by a number, which, in the 3rd denomination, is equal to an integer in the 2nd—the quotient shall be of the 3rd denomination; and if there be still a remainder, it must be multiplied by a number, which, in the 4th denomination, is equal to an integer in the 3rd; and divided as before, the quotient will be of the 4th denomination, and so on till the remainder cannot be reduced to any lower terms: thus you have the square or rectangle A C I L.

3.—C H and I O are two rectangles made by the multiplication of the sum of the greatest denomination given, by the sum given, which is of the 3rd lower denomination; the product shall be of the same denomination with the 3rd; and therefore if that product be greater than the integer of the second denomination, reduced into parts of the 3rd, it must be divided by a number, which, in the 3rd denomination, is equal to an integer in the 2nd; the quotient shall be of the 2nd denomination, and the remainder of the 3rd.

4.—G M and K P are two rectangles made by multiplying the sum of the 2nd denomination by the 3rd; and the product being divided by one of the integers in the greatest denomination, reduced into parts of the 2nd, the quotient shall be of the same denomination with the 3rd; and the remainder must be multiplied by a number, which in the 4th denomination is equal to an integer; in the third, the quotient shall be of the 4th denomination; and the remainder shall be the number of a fraction, whose denominator is that former divisor.

5.—L Q is the square of the 3rd denomination, which must be divided by one integer of the greatest denomination, reduced into the parts of the 3rd; the quotient shall be of the 4th lesser denomination, and the remainder shall be the numerator of a fraction, whose denominator is the same divisor.

PROBLEM 1.

To multiply pounds, shillings, and pence by the same; a pound being the integer.

RULE.—Pounds multiplied by pounds produce pounds. Pounds multiplied by shillings, every 20 is a pound, the rest shillings. Pounds multiplied by pence, every 12 is a shilling, and the rest pence. Shillings multiplied by shillings, every 20 is a shilling, every 5 is threepence, and each 1 is two farthings and four-tenths of a farthing. Shillings multiplied by pence, every 5 is a farthing, and each 1, two-tenths of a farthing. Pence multiplied by pence, every 60 is a farthing, and every 6 one-tenth of a farthing.

EXAMPLES.

19.—Multiply £3 5s. 6d. by £2 12s. 9d.

Observe:—The multiplication of money by money is looked upon as at variance with good taste; but critiques so frequently open the question, the author has taken a good deal of trouble to satisfy the desire of those who argue that pounds, shillings, and pence admit of the same solution as feet, inches, and parts.

EXPLANATION.

First, say, £2 by 3 make £6; 2ndly, £2 by 5s. is 10, and £3 by 12 is 36, whose sum is 46, which, by the 2nd direction, will be £2 6s.; 3rdly, £2 by 6d. is 12, and £3 by 9d. is 27, whose sum is 39, which, by direction the 3rd, will be 3s. 3d.; 4thly, 12s. by 5s. is 60, which, by direction the 4th, will be 3s.; 5thly, 12s. by 6d. is 72, and 5s. by 9d. is 45, whose sum is 117, which, by direction the 5th, will be $5\frac{4}{4}$d. and four-tenths; 6thly, 6d. by 9d. is 54, which, by direction the 5th, will be nine-tenths. Add the whole, and you will find £8 12s. $9\frac{3}{10}$d., as required.

Operation.

£	s.	d.	
3	5	6	
2	12	9	
6			
2	6		
	3	3	
	3		
		$5\frac{4}{4}$	$\frac{4}{10}$
			$\frac{9}{10}$
Ans. £8	12	$9\frac{3}{10}$	

20.—Multiply 2s. 6d. by 2s. 6d., a pound being the integer?

1st by Decimals.

21.—2s. 6d. or $\frac{1}{8}$ of a pound is

·125
·125

625
250
125

Ans. ·15625 = $3\frac{3}{4}$d.

2nd.—By Vulgar Fractions.

22.—Multiply $\frac{1}{8}$ of a pound by $\frac{1}{8}$ $\overline{\div 6\frac{1}{2}}$ 240d. = $3\frac{3}{4}$d. proof.

NOTE.—The above question was given in a former edition of this work, and finding few to understand it, the author has entered more fully into the explanation. To those who still stumble at the problem, he begs to refer them to the first and second book of "Euclid's Elements."

23.—Multiply 2s. 6d. by 2s. 6d., the integer being a shilling.

RULE.—Shillings multiplied by shillings produce shillings; shillings multiplied by pence, every twelve is a shilling, and the rest pence; shillings multiplied by farthings produce farthings; pence multiplied by pence, every twelve is a penny, and each three a farthing; pence multiplied by farthings, each twelve is a farthing, and every three is a quarter of a farthing; farthings multiplied by farthings, each 12 is a quarter of a farthing.

EXPLANATION.

× 2s. by 2s. make 4s., and 2s. by 6d. is 12, and twice 12 make 24, which is 2s.; then 6d. by 6d. is 36=3d. and all added=6s. 3d.

Operation.

2	6
2	6
4	0
2	0
	3
Ans. 6	3

The rule applied in Timber Measure.

24.—In a plank 8 ft. 7 in. 4 pts. long, and 5 ft. 9 in. 3 pts. broad, how many feet?

ft.	in.	p.		
8	7	4		
5	9	8		
43	0	8		
6	5	6	0	
	5	8	10	8
49	11	10	10	8 Ans.

NOTE.—Cross multiplication cannot be proved without a knowledge of the foregoing diagram.

COMPOUND DIVISION

Is dividing compound numbers into any proposed number of equal parts.

RULE.—Begin to divide the highest denomination; if anything remain, you must find how many of the next lower denomination that remainder is equal to, and add them to the next numbers of the same denomination; and so proceed with each denomination till the end.

EXAMPLES OF COIN.

1.				2.				3.			
£	s.	d.		£.	s.	d.		£	s.	d.	
÷2) 225	2	4	by 2	+3) 751	14	7½	by 3	+4) 821	17	9¾	by 4
112	11	2	Quot.	250	11	6½	Quot.	205	9	5 7/8	Quot.

4.—Divide £64 19s. by 36?—Ans. £1 16s. 1d.
5.—Divide £190 4s. 6d. by 42?—Ans. £4 10s. 7d.
6.—Divide £37 14s. 8d. by 48?—Ans. 15s. 8⅔d.
7.—Divide £4567 0s. 10d. by 55?—Ans. £83 0s. 8 9/11d.
8.—Bought 36 yds. of cloth for £17 2s.; what was it a yard?—Ans. 9s. 6d.

EXAMPLES IN WEIGHTS AND MEASURES.

9.—Divide 8 lbs. 1 oz. 15 dwts. 8 grs. by 2?—Ans. 4 lbs. 0 oz. 17 dwts. 16 grs.
10.—Divide 24 tons 14 cwts. 0 qrs. 14 lbs. by 3?—Ans. 8 tons 4 cwts. 2 qrs. 23½ lbs.
11.—Divide 147 yds. 2 ft. 11 ins. by 10?—Ans. 14 yds. 2 ft. 4 7/10 ins.
12.—Divide 24 hhds. 57 gals. by 11?—Ans. 2 hhds. 16 gals. 2 qts. 1 1/11 pts.

Repeat the rule for Compound Division.

ANALYZED COMPENDIUMS OF THE FOREGOING RULES.

PROBLEM 1.

To find what number of hundreds, pounds, yards, &c., may be bought for any sum, the price of one being given in any even number of shillings.

RULE.—Annex a cipher to the right hand of the given money, and divide by half the proposed price.

EXAMPLES.

13.—If a yard of cloth cost 8s., how many yards may be bought for £16?

£
÷ 4)160

Ans. 40 yards.

NOTE.—This plan obviates rule of three.

14.—How many yards of linen, at 6s. per yard, can I have for £48?—Ans. 160 yards.

15.—How many cwt. of sugar can I have for £80, if it be sold at 30s. per cwt?—Ans. 53 cwts. 1 qr. 9⅓ lbs.

16.—How many cwt. of butter, at 42s. per cwt., can I buy for £126? Ans. 60 cwts.

QUERIES.—The price of one being given in even shillings, how will you find the amount of any number of hundreds, yards, &c.? Repeat the rule.

PROBLEM 2.

To compute yards, quarters, ells, nails, lbs., gallons, &c., at any given number of pence, from ¼d. to 11¾d. per yard, per quarter, per ell, per nail, per lb., per gallon, &c., &c.

GENERAL RULE.—Exchange the quantity and price for each other, and multiply by the price; or find the amount at a penny, and multiply by the number of pence. If fractions occur, for ½ add ¼d., ¾ add ½d., ⅛ add ⅛d., and so on.

EXAMPLES.

17.—12 lbs. at 7d. per lb.: say 12d. are 1s., and 7 times 1 are 7s.

18.—48 lbs. at 9d. per lb.: 48d. are 4s., and 9 times 4 are £1 16s.

19.—84 lbs. at 7d. per lb.: 84d. are 7s., and 7 times 7 are £2 9s.

20.—132 lbs. at 11d. per lb.: 132d. are 11s., and 11 times 11 are £6 1s.

21.—252 gallons at 10d. per gallon: 252d. are 21s., and 10 times 21s. are £10 10s.

22.—300 lbs. at 7d. per lb.: 300d. are 25s., and 7 times 25s. are £8 15s.

When fractions occur in the quantity, as per rule; for a ½ allow a ¼d.; for a ¼ a ⅛d.

23.—42½ lbs. at 7d. per lb.: 42½d. are 3s. 6¼d., and 7 times 3s. 6¼d. are £1 4s. 9¾d.

24.—65¼ ozs., at 5d. per oz.: 65¼d. are 5s. 5¼d., and 5 times 5s. 5¼d. are £1 7s. 2¼d.
25.—87⅞ lbs., at 8d.: 87⅞d. are 7s. 3⅞d., and 8 times 7s. 3⅞d. are £2 18s. 6d.
26.—99⅛ yards, at 4d. per yard: 99⅛d. are 8s. 3⅛d., and 4 times 8s. 3⅛d. are £1 13s. 0½d.
27.—140⅜ ozs. at 7d. per oz.: 140⅜d. 11s. 8⅜d., and 7 times 11s. 8⅜d. are £4 1s. 10⅝d.
28.—88¼ lbs., at 7d. per lb.: 88¼d. are 7s. 4¼d., and 7 times 7s. 4¼d. are £2 11s. 5¾d.
29.—27 quires of paper, at 9¼d. per quire: 27d. are 2s. 3d., and 9¼ times 2s. 3d. are £1 0s. 9¾d.
30.*—183⅝ yards, at 10d. per yard: 183⅝d. are 15s. 3⅝d., and 10 times 15s. 3⅝d. are £7 13s. 0½d.

When a Fraction is in the Price.

RULE.—Call the lbs., yards, &c., pence, which bring to shillings and pence; multiply by the pence and fraction, as follows:—

31.—48 lbs., at 7¼d. per lb.: say 48d. are 4s., and 7¼ times 4s. are £1 9s.
32.—60 lbs., at 5½d. per lb.: 60d. are 5s., and 5½ times 5s. are £1 7s. 6d.
33.—72 lbs., at 9¾d. per lb.: 72d. are 6s., and 9¾ times 6s. are £2 18s. 6d.
34.—84 gallons, at 11½d. per gallon: 84d. are 7s., and 11½ times 7s. are £4 0s. 6d.
35.—96 yards, at 10¾d. per yard; 96d. are 8s., and 10¾ times 8s. are £4 6s.

NOTE.—As this rule is of importance to the accountant, it is expected it will be studied attentively. It will be found of great service to young men and shopkeepers.

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* It is necessary here to explain the application of this rule in the fractions. One example will suffice for all: we make use of the question, No. 30, for the purpose; the illustration will appear clear to any capacity.

We have here 183⅝ yards, at 10d. per yard:—

		s.	d.	
183⅝ = 15s. 3⅝d., and		15	3⅝	× by 10 stands thus:—
		10		
Ans.	£7	13	0½	

Multiply first the numerator of the fraction by 10, saying 10 times ⅝ are 50-8ths, which is 6 whole numbers, and 2-8ths or ¼; we write down ¼ and carry 6 to the pence; multiply the pence and shillings in the ordinary way, and so on with any other number. Remember, after multiplying the numerator, divide by the denominator, and the quotient will be so many pence; set down the remaining fraction in its proper place, and carry to the pence.

All mercantile transactions being made for money, and pounds, shillings, and pence being the principal denominations of the present currency, and so regulated that Twelve Pence make One Shilling, and Two Hundred and Forty Pence One Pound, the equations of two numbers embrace the whole of mercantile calculations.

NEW TABLE BY THE EQUATION OF TWELVE.

For 15	take 1	one-fourth times	12	For 85	take 7 one-twelfth times .. 12
.. 17	 1	five-twelfth	12	.. 87	.... 7 one-fourth 12
.. 19	 1	seven-twelfth	12	.. 89	.... 7 five-twelfth 12
.. 20	 1	two-third	12	.. 91	.... 7 seven-twelfth 12
.. 21	 1	three-fourth.....	12	.. 93	.... 7 three-fourth 12
.. 22	 1	eleven-twelfth	12	.. 95	.... 7 eleven-twelfth 12
.. 26	 2	one-sixth	12	.. 97	.... 8 one-twelfth 12
.. 28	 2	one-third	12	.. 99	.... 8 one-fourth 12
.. 29	 2	five-twelfth	12	.. 101	.... 8 five-twelfth 12
.. 31	 2	seven-twelfth	12	.. 103	.... 8 seven-twelfth..... 12
.. 33	 2	three-fourth	12	.. 105	.... 8 three-fourth 12
.. 35	 2	eleven-twelfth	12	.. 107	.... 8 eleven-twelfth 12
.. 37	 3	one-twelfth	12	.. 109	.... 9 one-twelfth 12
.. 39	 3	one-fourth	12	.. 111	.... 9 one-fourth 12
.. 41	 3	five-twelfth	12	.. 113	.... 9 five-twelfth 12
.. 43	 3	seven twelfth	12	.. 115	.... 9 seven-twelfth 12
.. 45	 3	three-fourth.....	12	.. 117	.... 9 three-fourth 12
.. 47	 3	eleven twelfth	12	.. 119	.... 9 eleven-twelfth 12
.. 50	 4	one-sixth	12	.. 121	....10 one-twelfth 12
.. 52	 4	one-third	12	.. 123	....10 one-fourth 12
.. 54	 4	one-half.....	12	.. 125	....10 five-twelfth..... 12
.. 55	 4	seven-twelth.....	12	.. 127	....10 seven-twelfth..... 12
.. 57	 4	three-fourth	12	.. 129	....10 three-fourth 12
.. 59	 4	eleven-twelfth.....	12	.. 131	....10 eleven twelfth 12
.. 61	 5	one-twelfth	12	.. 133	....11 one-twelfth 12
.. 63	 5	one-fourth	12	.. 135	....11 one-fourth 12
.. 65	 5	five twelth	12	.. 137	....11 five-twelfth 12
.. 67	 5	seven-twelfth	12	.. 139	....11 seven-twelfth 12
.. 69	 5	three-fourth.....	12	.. 141	....11 three-fourth 12
.. 71	 5	eleven-twelfth.....	12	.. 143	....11 eleven-twelfth 12
.. 73	 6	one-twelfth	12	.. 145	....12 one-twelfth..... 12
.. 75	 6	one-fourth.....	12	.. 147	....12 one-fourth 12
.. 77	 6	five-twelfth	12	.. 149	....12 five-twelfth 12
.. 79	 6	seven-twelfth	12	.. 151	....12 seven-twelfth 12
.. 81	 6	three-fourth.....	12	.. 153	....12 three-fourth 12
.. 83	 6	eleven-twelfth.....	12	.. 155	....12 eleven-twelfth 12

If the pupil makes himself conversant with the above table, he will be able in an instant, to tell the amount of any quantity, at any price, from 12 to 240. It was constructed for the system, in order to facilitate the calculation of either even, odd, evenly even, evenly odd, oddly odd, composite, plain, solid, perfect, harmonic, and square numbers, in any case, as far as 12 reaches.

EXERCISE. I.

Given the value of an Integer to determine the price of any proposed number of the same kind, by the equation of twelve.

THIS proposition, and its equivalent, developes the whole system of mercantile calculations, and can be briefly analyzed into three particular cases.

First, the number whose value is required, must be either equal, greater, or less than 12. If 12, it admits of but one infallible rule; if less, of three; and if greater, of four operative ones.

With respect to the particular cases: observe, that a number less than 12, may be an exact measure of 12, or prime to it; also, a number greater than 12 may be a multiple of 12, or prime to it. Each of these cases will be minutely considered, and carefully arranged under its distinct head; and as 12 is the equation to this section, we shall first take it into consideration.

GENERAL RULE.—Call the pence which one costs shillings. If a halfpenny, farthing, or three farthings, be affixed to the price, call the halfpenny sixpence, and count three pence for each farthing. If fractions occur, for $\frac{1}{2}$, say 1½d.; $\frac{3}{8}$, 4½d.; $\frac{7}{8}$, 7½d.; $\frac{1}{12}$, 1d.; $\frac{3}{12}$, 3d.; $\frac{7}{12}$, 7d.; $\frac{1}{6}$, 2d.; $\frac{5}{6}$, 10d.; $\frac{1}{24}$, ½d.

The *Reason* of this rule is founded on the general principle. If a lb. cost 1d., one shilling will be the cost of 12 lbs., that is, a shilling to the penny. Hence, as many pence as a lb. costs, so many shillings will 12 lbs. cost: if a lb. costs a halfpenny, 12 lbs. will cost sixpence; and if a lb. costs a farthing, 12 lbs. will cost threepence, and the fractions in proportion.

PROBLEM 1.

Knowing the price of 1, *to find the value of* 12, *as per rule.*

EXAMPLES.

1.—If a lb. of sugar cost sevenpence, 12 lbs. will cost as many shillings; if a lb. cost 6½d., call the sixpence six shillings, and the halfpenny sixpence, and it will be the price of 12 lbs.

2.—If a yard cost 9¼d., call the 9d. nine shillings, and 3d. for the farthing, you have the price of 12 yards = 9s. 3d. Again, if a yard cost 5¾d., call the 5d. five shillings, and count 9d. for the three farthings, you have the price of 12 yards = 5s. 9d.

Finally, if the price per integer should amount to shillings, pence, &c., reduce the shillings and pence to pence; call the pence shillings, and you have the amount of 12 lbs., as per rule.

A few examples will render this exercise familiar, which the learner is particularly cautioned not to pass over until he is able to tell at once the amount of 12, at any proposed price per integer, which is best effected by studying attentively and practising the following examples :—

3.—At 17½d. per yard, what is the value of 12 yards?—Ans. 17s. 6d.
4.—At 15½d. per lb., what is the value of 12 lbs.?—Ans. 15s. 9d.
5.—12 dozen of sherry, at £1 18s. 9d. per dozen?—Ans. £23 5s.
6.—12 pieces of calico, 5s. 3¾d. per piece?—Ans. £3 3s. 9d.
7.—12 dozen of ribbon, at 4s. 7½d. per dozen?—Ans. £2 15s. 1½d.
8.—12 lbs. of thread, at 1s. 11⅝d. per lb.?—Ans. £1 3s. 10d.
9.—12 pieces of lawn, at 13s. 9½d. per piece?—Ans. £8 5s. 10½d.
10.—12 ounces of silver, at 4s. 7 5/16d. per ounce?—Ans. £2 15s. 2¼d.

PROBLEM 2.

To calculate the amount of any number, from 12 *to* 24.

RULE 2.—Call the pence, &c., which the integer costs shillings, which increase by the same part of itself that the excess is of 12, if the excess be an exact measure of 12; but if prime, add the value of the prime part; the sum will be the value of the proposed number.

EXAMPLES.

11.—What is the value of 18 lbs. of beef, at 5½d. per lb.?—Ans. 8s. 3d.
12.—What is the price of 17 lbs. of butter, at 13½d. per lb.?—Ans. 18s. 9½d.
13.—What will 23 lbs. of tea cost, at 6s. 7½d. per lb.?—Ans. £7 12s. 4½d.
14.—What is 13¾ gallons of brandy worth, at 15s. 9½d. per gallon?—Ans. £10 17s. 1⅛d.
15.—What is 19½ reams of paper worth, at 7s. 9¾d. per ream?—Ans. £7 12s. 4½d.
16.—What will 23½ lbs. of leather come to, at 2s. 8½d. per lb.?—Ans. £3 3s. 7¾d.

PROBLEM 3.

The reverse; having the amount of twelve, to find the price of one.

RULE 3.—As many shillings as twelve are worth, so many pence will one cost.

EXAMPLES.

17.—If 12 pigeons cost 8s., what is one worth?—Ans. 8d.
18.—If 12 yards of linen costs 16s., what is the price of one?—Ans. 1s. 4d.
19.—If 12 pairs of stockings cost 4s. 8d., what is that a pair?—Ans. 4⅜d.
20.—Bought 12 gallons of cider for £1, what is that a gallon?—Ans. 1s. 8d.
21.—Paid 30s. for 12 handkerchiefs, what were they a piece? Ans. 2s. 6d.
22.—Paid £6 for a dozen hats, what was that for one?—Ans. 10s.
23.—If a dozen of gloves cost £2 16s., what is that a pair?—Ans. 4s. 8d.
24.—12 cloth caps for £1 7s., what is that for one?—Ans. 2s. 3d.
25.—12 bottles of port wine cost £2 8s., what is that a bottle?—Ans. 4s.

PROBLEM 4.

Having the price of any number of which 12 *is a multiple, to find the price of one.*

RULE 4.—Find how many twelves are in the number of articles; then bring the amount into shillings, and divide by the number of twelves; the result will be the price of one in pence.

EXAMPLES.

26.—Bought 48 pairs of scissors for £1 4s., what is that a pair?—Ans. 6d.
27.—72 yards of drab cloth for £3 6s., what is that a yard?—Ans. 11d.
28.—48 chair covers for £1 16s., what was the price of one?—Ans. 9d.
29.—60 brass finger plates for £7 10s., what is one worth?—Ans. 2s. 6d.
30.—120 flower pots for £2, what is one worth at that rate?—Ans. 4d.
31.—132 wine glasses for £4 19s., what is the price of one?—Ans. 9d.
32.—108 pieces of dinner service for £2 5s., what is that a piece?—Ans. 5d.
33.—96 glass frames for £62 16s., what is that a piece?—Ans. 13s. 1d.

Repeat the rule for finding the price of any number of which 12 is a multiple, the price of one being given.

PROBLEM 5.

The amount of any number of articles given, not an even multiple of 12, *to find the value of one.*

RULE 5.—Call the number of articles pence. If these pence amount to shillings and pence, divide the shillings of the given value by the shillings, and the pence also by the pence. If both the pence and shillings give the same product, that number is the value of one article in pence.

EXAMPLES.

34.—If I pay £2 9s. 7d. for 85 lamp glasses, what is the cost of one?

85 glasses as pence = 7s. 1d.
£2 9s. 7d. = 49s. 7d. Divide 49s. by 7s. = 7d., price of one lamp.
Divide 7d. by 1d. = 7d. Ans.

NOTE.—Observe, the product of both divisions is 7; therefore, the price of one lamp is 7d.

35.—107 yards of printed calico for £4 0s. 3d., what was it per yard?

	s.	d.		s.	d.	s.	s.
Yards as pence, 107 =	8	11.	÷	8	11)	80	3 = 9 = 9d., value of one yard.
£4 0s. 3d. =	80	3.					

Observe, that 8 is contained in 80 exactly 10 times; but 11 cannot be divided into 3; therefore take one less, and carry the surplus to the pence and divide by 11, and the sum 9 = 9d. is the result. Adopt a similar course in every other case.

36.—Bought at a sale 42 salvers for £1 18s. 6d., what was that a piece?—Ans. 11d. each.
37.—Bought 109 knives for £2 5s. 5d., what are they a piece?—Ans. 5d.

38.—37 drawing copies for £1 13s. 11d., what is one worth?—Ans. 11d.
39.—If 63 squares of glass cost 15s. 9d., what is one worth?—Ans. 3d.
40.—If 37 rabbits cost £1 13s. 11d., what is one worth?—Ans. 11d.
41.—If 83 pickled tongues cost £3 2s. 3d., what is one worth?—Ans. 9d.
42.—If 77 quarts of oil cost £3 10s. 7d., what is one worth?—Ans. 11d.
43.—If 113 peaches cost £2 16s. 6d., what is one worth?—Ans. 6d.
44.—35 ounces of thread for £1 3s. 4d., what is that per ounce?—Ans. 8d.
45.—Bought 22 hand-baskets for 18s. 4d., what is that a piece?—Ans. 10d.
46.—129 door-handles for £4 16s. 9d., what is that a piece?—Ans. 9d.

PROBLEM 6.

To calculate for any multiple of 12, *or for any number that contains* 12, *evenly, the price of one being given.*

RULE 6.—Call the pence shillings, the halfpenny 6d., and count 3d. for every farthing, as taught in rule the first; which multiply by the number of twelves contained in the given number; the result will be the answer.

Reason.—When the price of one in pence is called shillings, it is the value of 12; and when the value of 12 is multiplied by the number of twelves, the result is the amount of the given number.

47.—What is the price of 24 lbs. of beef, at 3¾d. per lb.?

Write 3s. 9d. for 3¾d., and it is the value of 12, per rule the first; and this multiplied by 2, the number of twelves contained in the given number is the answer.

d.	s.	d.	
3¾ =	3	9	as per rule.
		2	
Ans.	7s.	6d.	

48.—What are 24 lbs. of cheese worth, at 6½d. per lb.?—Ans. 12s. 6d.
49.—What are 36 lbs. of mutton worth, at 4½d. per lb.?—Ans. 13s. 6d.
50.—72 lbs. of lamb, at 9½d. per lb.?—Ans. £2 15s. 6d.
51.—84 yards of silk velvet, at 9s. 8¾d. per yard?—Ans. £40 17s. 3d.
52.—96 parlour locks, at 3s. 7½d. each?—Ans. £17 8s.
53.—120 pair of gloves, at 2s. 3½d. a pair?—Ans. £13 15s.
54.—120 gallons of rum, at 13s. 10d. per gallon?—Ans. £83.
55.—132 quarters of barley, at £1 13s. 9d. per quarter?—Ans. £222 15s.
56.—108 yards, at 2s. 9½d. per yard?—Ans. £15 1s. 6d.

QUERY.—How do you calculate the amount of any multiple of 12? Give the rule and the reason.

PROBLEM 7.

Having the price of one, to find the amount of any aliquant number greater than 12, *at the same rate per integer.*

RULE 7.—Set down the price of twelve; multiply by the number of twelves contained in the given number, to which add the amount of the prime part; the whole added will be the amount of the proposed number.

57.—What is the amount of 25½ stones of wheat, at 17½d. per stone?

£	s.	d.	
0	17	6	× 2
1	15	0	
1½ =	2	2½	
Ans. £1	17	2½	

58.—What is the price of 73 lbs. of butter, at 6½d. per pound? Ans. £1 19s. 6½d.

59.—What is the amount of 85 lbs. of beef, at 8¼d. per pound? Ans. £1 3s. 0¼d.

60.—What is the price of 137 lbs. of worsted, at 17½d. per pound? Ans. £9 19s. 9½d.

61.—What will 90 lbs. of tobacco come to, at 3s. 6½d. per pound? Ans. £15 18s. 9d.

62.—What is the amount of 104 yards of broad cloth, at 8s. 6¾d. per yard? Ans. £44 10s. 6d.

63.—What is the price of 47 cwt. of fine flour, at 16s. 8½d. per cwt.? Ans. £39 5s. 3½d.

64.—What is the cost of 76 gallons of rum, at 14s. 8½d. per gallon? Ans. £55 17s. 10d.

65.—What will the yearly rent of a farm, containing 52 acres, come to, at £1 3s. 6d. per acre? Ans. £61 2s.

QUERY.—To find the amount of any number, greater than 12, but prime to it, how do you proceed? Give the rule.

EXERCISE II.

CALCULATION OF LACE.

As the lace trade generally embraces a variety of fractions, often presenting difficulties to both buyer and seller, the following examples will be found sufficient to facilitate the accountant in totting up the amount of any quantity, at any price per dozen, with the greatest despatch. The same method may be applied where fractions are annexed to the price of any article.

RULE 1.—Apply the equation 12 as before directed. For $\frac{1}{8}$, count 1½d.; for $\frac{1}{16}$, ¾d.; for $\frac{1}{32}$, ⅜d.; $\frac{1}{64}$, $\frac{3}{16}$d.; $\frac{1}{128}$, $\frac{3}{32}$d.

EXAMPLES.

1.—What is the amount of 2 dozen of Nottingham lace, at 16 $\frac{1}{16}$d. per yard?

Operation.

	s.	d.		s.	d.	
12 yards, at 1		$4\frac{1}{16}$	=	16	$0\frac{4}{4}$,	which double for 2 dozen.
				2		
Ans.	£1	12			$1\frac{1}{4}$	

2.—What will $2\frac{1}{4}$ dozen of edging come to, at $3\frac{3}{4}$d. per yard? Ans. 9s. $4\frac{1}{4}$d.

3.—What is the amount of $5\frac{1}{2}$ dozen of thread lace, at 1s. $10\frac{1}{2}$d. per yard? Ans. £6 1s. $2\frac{1}{16}$d.

4.—What will $9\frac{3}{8}$ dozen figured lace come to, at $9\frac{3}{16}$d. per yard? Ans. £4 7s. $3\frac{3}{8}$d.

5.—Tell the amount of $16\frac{1}{4}$ dozen of silk lace, at 5s. $7\frac{3}{4}$d. per yard? Ans. £54 14s. $10\frac{1}{8}$d.

6.—What will $23\frac{1}{2}$ dozen of French lace come to, at 2s. $11\frac{6}{16}$d. per yard? Ans. £41 9s. $10\frac{1}{2}$d.

7.—If a yard of flowered lace cost 3s. $2\frac{9}{2}$d., what will $27\frac{1}{4}$ dozen come to? Ans. £53 2s. $3\frac{3}{8}\frac{1}{2}$d.

8.—If a yard of fancy Brussels lace cost 9s. $10\frac{9}{16}$d., what will $47\frac{1}{4}$ dozen come to? Ans. £280 2s. $0\frac{1}{16}\frac{5}{8}$d.

9.—What will $76\frac{3}{4}$ dozen of blond lace come to, at 9s. $5\frac{7}{2}$d. per yard? Ans. £434 9s. $6\frac{1}{8}\frac{5}{2}$d.

10.—$127\frac{1}{2}$ dozen of fancy wrought lace, at 2s. $1\frac{5}{16}$d. per yard? Ans. £165 7s. $0\frac{3}{4}$d.

EXERCISE III.

PROBLEM 1.

To find the price of a gross, the price of an article being given.

RULE 1.—Reckon the pence in the price of one article as shillings, and the number of pence in these shillings will be the price of a gross in shillings.

Reason.—Because, taking the pence in the price as shillings is the same as multiplying by twelve, and taking these shillings as pence again, is the same as × 12 by 12 = 144 = one gross.

EXAMPLES.

1.—One gr., at $8\frac{1}{4}$d.? Ans. 99s.
2.—One gr., at $9\frac{1}{2}$d.? Ans. 114s.
3.—One gr., at $11\frac{3}{4}$d.? Ans. 141s.
4.—One gr., at $12\frac{1}{4}$d.? Ans. 147s.
5.—One gr., at $13\frac{1}{2}$d.? Ans. 162s.
6.—One gr., at $16\frac{1}{2}$d.? Ans. 198s.
7.—One gr., at $19\frac{1}{4}$d.? Ans. 231s.
8.—One gr., at $23\frac{3}{4}$d.? Ans. 285s.

EXERCISE IV.

PROBLEM 2.

To find the price per score, the price of one being given.

RULE 1.—Call the shillings pounds, and then see what proportion the pence bears to the shillings, which you are to add to the shillings also for pounds.

EXAMPLES.

9.—Twenty pair of gold ear-rings, at 19s. 9d. per pair? Ans. £19 15s.

Reason.—9d. = $\frac{3}{4}$ of a shilling; and 15s. = $\frac{3}{4}$ of a pound.

10.—Twenty yards of broad cloth, at 11s. 6d. per yard? Ans. £11 10s.
11.—Twenty volumes of Burns' poems, at 13s. 9d. a piece? Ans. £13 15s.
12.—Twenty bibles, morocco binding, at 39s. 9d. a piece? Ans. £39 15s.
13.—Twenty sacks of flour, at £2 7s. 6d. a sack? Ans. £47 10s.
14.—Sixty mahogany chairs, stuffed, at £1 2s. 9d. a piece? Ans. £68 5s.
15.—One hundred silver tea spoons, at 11s. 4d. each? Ans. £56 13s. 4d.

QUERY.—The price of one being given, how do you find the price of a score?

EXERCISE V.

PROBLEM 3.

To find the value of 100 *articles, the price of one being given.*

RULE 1.—For every farthing in the price, take as many pence, and twice as many shillings. Thus, 100 pencils, at 1½d. each, is 12s. 6d. Six being the number of farthings.

Reason.—Because, by taking a penny for every farthing, is the same as multiplying by four; and taking two shillings for every farthing, is the same as multiplying by ninety-six; and 96 + 4 = 100.

EXAMPLES.

16.—One hundred copy-books, at 4½d. each? Ans. £1 17s. 6d.
17.—One hundred quarts of vinegar, at 1s. 3¾d. a quart? Ans. £6 11s. 3d.
18.—One hundred hearth brushes, at 2s. 3½d. a piece? Ans. £11 7s. 1d.
19.—One hundred silver chains, at 17s. 10½d. each? Ans. £89 5s. 5d.
20.—One hundred yards of mason work, at 5¾d. a yard? Ans. £2 7s. 11d.
21.—One hundred guard chains, at 7s. 6¾d. a piece? Ans. £37 16s. 3d.
22.—One hundred yards of silk binding, at 14½d. a yard? Ans. £6 0s. 10d.

PROBLEM 4.

By knowing the amount of 100, *to find the price of one.*

RULE 2.—To eight times the amount add one fifth of itself, and the sum is the answer in farthings.

EXAMPLES.

23.—If 100 articles cost £2 18s. 4d. what is one worth?

£	s.	d.	
2	18	4	
		8	
÷5) 23	6	8	
4	13	4	
Ans. 28	0	0	=28 far., or 7d.

24.—If 100 geese cost £11 13s. 4d., what is that a piece? Ans. 2s. 4d.

25.—If 100 yards cost £5 16s. 8d., what will one cost?

£	s.	d.	
5	16	8	
		8	
+5) 46	13	4	
9	6	8	
Ans. 56	0	0	=56 far., or 14d.

26.—If 100 lbs. of tea cost £27 10s., what will one cost? Ans. 5s. 6d.

BY THE EQUATION OF TWO HUNDRED AND FORTY.

As the table of 12, *with its equations, meet all calculations up to this stage, we now introduce to the student a new table, with the equation of* 240, *similarly constructed, and which may be carried to infinity.*

For 340	take	1	five-twelfth times	240	For 700	take	2 eleven-twelfth times 240
.. 350	....	1	eleven-twenty-fourth	240	.. 710	....	2 twenty-three-24th .. 240
.. 360	....	1	one-half	240	.. 720	....	3 240
.. 370	....	1	thirteen-24th	240	.. 730	....	3 one-twenty-fourth .. 240
.. 380	....	1	seven-twelfth	240	.. 740	....	3 one-twelfth 240
.. 390	....	1	five-eighth	240	.. 750	....	3 one-eighth 240
.. 400	....	1	two-third	240	.. 760	....	3 one-sixth 240
.. 410	....	1	seventeen-24th	240	.. 770	....	3 five-twenty-fourth . 240
.. 420	....	1	one three-fourth	240	.. 780	....	3 one-fourth 240
.. 430	....	1	nineteen-24th	240	.. 790	....	3 seven-24th 240
.. 440	....	1	five-sixth	240	.. 800	....	3 one-third 240
.. 450	....	1	seven-eighth	240	.. 810	....	3 three-eight 240
.. 460	....	1	eleven-twelfth	240	.. 820	....	3 five-twelfth 240
.. 470	....	1	twenty-three-24th	240	.. 830	....	3 eleven-24th 240
.. 480	....	2	.....	240	.. 840	....	3 one-half 240
.. 490	....	2	one-twenty-fourth ..	240	.. 850	....	3 thirteen 24th 240
.. 500	....	2	one-twelfth	240	.. 860	....	3 seven-twelfth 240
.. 510	....	2	one-eighth	240	.. 870	....	3 five eighth 240
.. 520	....	2	one-sixth	240	.. 880	....	3 two-third 240
.. 530	....	2	five-twenty-fourth ..	240	.. 890	....	3 seventeen-24th 240
.. 540	....	2	one-fourth	240	.. 900	....	3 three-fourth 240
.. 550	....	2	seven-24th	240	.. 910	....	3 nineteen-24th 240
.. 560	....	2	one-third	240	.. 920	....	3 five-sixth 240
.. 570	....	2	three-eighth	240	.. 930	....	3 seven-eighth 240
.. 580	....	2	five-twelfth	240	.. 940	....	3 eleven-twelfth 240
.. 590	....	2	eleven-twenty-fourth.	240	.. 950	....	3 twenty-three-24th .. 240
.. 600	....	2	one-half	240	.. 960	....	4 240
.. 610	....	2	thirteen-24th	240	.. 1000	....	4 one-sixth 240
.. 620	....	2	seven-twelfth	240	.. 1200	....	5 240
.. 630	....	2	five-eighth	240	.. 1440	....	6 240
.. 640	....	2	two-third	240	.. 1680	....	7 240
.. 650	....	2	seventeen-24th	240	.. 1920	....	8 240
.. 660	....	2	three-fourth	240	.. 2160	....	9 240
.. 670	....	2	nineteen-24th	240	.. 2400	....	10 240
.. 680	....	2	five-sixth	240	.. 2640	....	11 240
.. 690	....	2	seven-eighth	240	.. 2880	....	12 240

NOTE.—The pupil is recommended to pay particular attention to the foregoing table: its object is to facilitate the progress of those who wish to become expert calculators. The ingenious boy will see that the intermediate numbers can be found at once. The system is general, and will answer any number proposed. It will obviate the old Rule of Three and Practice systems; a hateful remembrance to those who have spent years over them, and a terror to the tyro who has the dreary path before him.

EXERCISE VI.

PROBLEM 1.

The price of one being given, to compute the amount of any number at, under, or over two hundred and forty.

GENERAL RULE 1.—Call the pence which the unit costs pounds. If a halfpenny, farthing, or three farthings be affixed to the price, call the halfpenny ten shillings, and count five shillings for each farthing; if fractions be annexed, for $\frac{1}{4}$ take 2s. 6d.; $\frac{1}{10}$, 2s.; $\frac{1}{12}$, 1s. 8d.; $\frac{1}{16}$, 1s. 3d.; $\frac{1}{32}$, 7½d.; $\frac{1}{64}$, 3¾d.; and $\frac{1}{128}$, 1⅞d. and you have the price at 240. Then as often as 240 is contained in the number you have to find for, so many times will be your equation or multiple: add or subtract the value of the odd numbers to that found, and you will have the result.

Reason.—If a pound costs a penny, 240 lbs. will cost a pound. As many pence as the pound costs, so many pounds will be the cost of 240 lbs.; if 1 lb. costs a halfpenny, 240 lbs. will cost ten shillings; if a farthing, 240 lbs. will cost five shillings; if an ¼d., 240 yards will cost 2s. 6d.; $\frac{1}{10}$, 2s.; $\frac{1}{12}$, 1s. 8d.; $\frac{1}{16}$, 1s. 3d.; $\frac{1}{32}$, 7½d.; $\frac{1}{64}$, 3¾d.; and $\frac{1}{128}$, 1⅞d.

EXAMPLES.

1.—240 yards, at 19½d. per yard? Ans. £19 5s.
2.—240 lambs, at 7s. 7½d. per lamb? Ans. £91 15s.
3.—240 gallons of brandy, at 16s. 9¼d. a gallon? Ans. £201 0s. 3¾d.
4.—240 yards of Yorkshire cloth, at 16s. 7¾d. per yard? Ans. £199 15s.
5.—243 quarters of oats, at 54s. 9¼d. per quarter? Ans. £665 9s. 3¾d.
6.—247 yards of broad cloth, at 13s. 7¾d. per yard? Ans. £168 2s. 9¾d.
7.—260 chased salvers, at 23s. 7¼d. a piece? Ans. £306 17s. 1d.
8.—280 yards of superfine cloth, at 27s. 9¾d. per yard? Ans. £389 7s. 6d.
9.—301 yards of silk, at 17s. 9¾d. per yard? Ans. £267 15s. 3¾d.
10.—400 yards of silk velvet, at 21s. 7¾d. per yard? Ans. £432 18s. 4d.

PROBLEM 2.

To calculate for any number commensurate with 240.

RULE 2.—Call the pence which the integer costs pounds, the halfpenny ten shillings, and reckon five shillings for each farthing, as per rule 1st, which multiply by the number of times the given number contains, two hundred and forty, the result, will be the amount.

What is the amount of each of the following commodities, at their respective prices per integer?

EXAMPLES.

11.—What are 480 yards worth, at 17¾d. per yard? Ans. £35 10s.
12.—What are 720 lbs. worth, at 7½d. per lb.? Ans. £21 15s.
13.—What are 960 stones of barley worth, at 10½d. per stone? Ans. £42.
14.—What are 1200 lbs. of beef worth, at 4¼d. per lb.? Ans. £21 5s.
15.—What are 1440 lbs. of tobacco worth, at 3s. 9d. per lb.? Ans. £270.
16.—What are 1680 lbs. of snuff worth, at 5s. 5½d. per lb.? Ans. £458 10s.
17.—What are 1920 lbs. of mutton worth, at 7d. per lb.? Ans. £56.
18.—What are 2160 yards of linen worth, at 15½d. per yard? Ans. £137 5s.

PROBLEM 3.

The amount of any number greater than 240, *but prime to it.*

RULE 3.—Call the pence, &c., which the integer costs pounds as per rule; then multiply by the number of times that 240 is contained in the given number: add the value of the prime part, and the sum will be the amount.

EXAMPLES.

19.—What is 247 stones of wheat worth, at 15¾d. per stone? Ans. £16 4s. 2¼d.
20.—967 lbs. of rice, at 4½d. per lb.? Ans. £18 2s. 7½d.
21.—1209 lbs. of sugar, at 6½d. per lb.? Ans. £32 14s. 10½d.
22.—1199¾ lbs. of tea, at 5s. 5½d. per lb.? Ans. £327 8s. 7½d.
23.—719½ lbs. of honey, at 2¾d. a lb.? Ans. £8 4s. 10⅝d.

PROBLEM 4.

To calculate the amount of any aliquot part under 240, *at any price per integer.*

RULE 4.—Call the pence pounds, as per general rule, and take the aliquot part of 240 for the amount proposed.

EXAMPLES.

24.—What is 20 stones of wheat worth, at 17½d. per stone? Ans. £1 8s. 9d.
25.—30 lbs. of coffee, at 18d. per lb.? Ans. £2 5s.
26.—40 pecks of oats, at 15½d. per peck? Ans. £2 11s. 8d.
27.—48 stones of bran, at 10d. per stone? Ans. £2.
28.—60 stones of flax, at 3s. 7½d. per stone? Ans. £10 17s. 6d.
29.—80 stones of wool, at 11s. 11¾d. per stone? Ans. £47 18s. 4d.

PROBLEM 5.

To find the value of any number less than 240, *so that the deficiency may be an aliquot part thereof.*

RULE 5.—From the price of the integer, written as per rule, take the part; and the remainder will be the cost of the proposed number.

EXAMPLES.

30.—What is the value of 160 stones of wheat, at 15d. per stone?

£15, the cost of 240.
One-third 5, the cost of 80, the deficiency.

£10, value of the proposed number.

31.—180 lbs. of beef, at 4½d. per lb.? Ans. £3 7s. 6d.
32.—200 lbs. of iron, at 2½d. per lb.? Ans. £1 17s. 6d.
33.—220 lbs. of sugar, at 6½d. per lb.? Ans. £5 19s. 2d.
34.—210 lbs. of coffee, at 1s. 8d. per lb.? Ans. £17 10s.

PROBLEM 6.

The amount of any number greater than 240, so that the excess may be an aliquot part thereof.

RULE 6.—Write the pence as pounds, to which add such part of the same as the excess is of 240; the sum will be the amount.

EXAMPLES.

35.—What are 260 lbs. of tea worth, at 2s. 7½d. per lb.? Ans. £34 2s. 6d.
36.—What are 270 lbs. worth, at 13½d. per lb.? Ans. £15 3s. 9d.
37.—What are 280 lbs. worth, at 9½d. per lb.? Ans. £10 15s. 10d.
38.—What are 300 lbs. worth, at 11¼d. per lb.? Ans. £14 1s. 3d.
39.—What are 320 lbs. worth, at 8½d. per lb.? Ans. £11 13s. 4d.
40.—What are 360 lbs. worth, at 15½d. per lb.? Ans. £23 12s. 6d.
41.—What are 560 lbs. worth, at 11¼d. per lb.? Ans. £26 5s.
42.—What are 600 lbs. of loaf sugar worth, at 10½d. per lb.? Ans. £26 5s.
43.—What are 760 lbs. worth, at 18½d. per lb.? Ans. £58 11s. 8d.

NOTE.—This mode of calculation may be carried as far as you please. It is evident how any odd number may be computed: it is only requisite to find the amount of the even part, as is already shown, to which add the value of the prime part, and you have the total.

PROBLEM 7.

To calculate the amount of 240, or any number commensurate with 240, at pounds, shillings, pence, farthings, &c., per integer.

RULE 7.—First, find for 240, at so many pounds; then for the shillings, pence, farthings, fractions, &c. All these sums added, will give the amount required.

EXAMPLE.

44.—What is the value of 240 yards of broad cloth, at £1 7s. 7½d. per yard?

*240 at	1	0	0	=	240	0
240 at	0	7	0	=	84	0
240 at	0	0	7	=	7	0
240 at	0	0	0½	=	0	10
				Ans.	£331	10

* A method by addition for those not very well conversant with multiplication.

EXPLANATION.

240 yards, at one pound, will be two hundred and forty pounds; 240 yards, at seven shillings per yard, will be eighty-four pounds; 240 yards, at sevenpence per yard, will be seven pounds; and 240 yards, at one halfpenny per yard, will be ten shillings; making in all £331 10s.

To impress this more forcibly on the mind, let the following questions be solved by the same method:—

45.—360 ounces of gold, at £3 8s. 4½d. per ounce? Ans. £1230 15s.
46.—960 cwt. of sugar, at £2 11s. 4d. per cwt.? Ans. £2464.
47.—1680 quarters of wheat, at £2 12s. 7d. per quarter? Ans. £4417.
48.—1920 quarters of barley, at £2 1s. 10d. per quarter? Ans. £4016.
49.—2400 yards of silk, at £3 1s. 7d. per yard? Ans. £7390.
50.—2880 ounces of gold, at £4 15s. 10d. per oz.? Ans. £13800.
51.—1784½ lbs. of silver, at £3 5s. 9d. per lb.? Ans. £5866 10s. 10½d.
52.—1873¼ cwt. of tallow, at £2 13s. 5d. per cwt.? Ans. £5003 2s. 9½d.

NOTE.—If the number proposed be odd, first find the amount of the even part, to which add the value of the odd number.

PROBLEM 8.

To compute any quantity in whole numbers, at an integral number of shillings per integer.

RULE 8.—Multiply the proposed number by half the price, when even, or by half the greatest even number contained therein; when odd, double the unit's figure of the product for shillings, the remainder will be pounds; but for the odd part, add its amount, at a shilling per integer.

EXAMPLES.

53.—At 13s. per yard, what is the value of 83 yards?

83 yards
½ of 13 = 6*

49 16 at 12s.
83s. are 4 3 at 1s.

Ans. £53 19

54.—270 yards, at 2s. per yard? Ans. £27.
55.—650 lbs. of tea, at 4s. per lb.? Ans. £130.
56.—640 yards of silk, at 6s. per yard? Ans. £192.
57.—572 yards of velvet, at 8s. per yard? Ans. £228 16s.
58.—673 yards, at 10s. per yard? Ans. £336 10s.
59.—763 yards, at 12s. per yard? Ans. £457 16s.

* *Reason.*—There are six twos contained in the greatest even number in 13, and when 83 is multiplied by 6, it produces 498 twos, the tenth of which will be pounds; but its tenth is the whole product of the unit's figure, which is multiplied by 2, producing shillings, being the same in effect as multiplying it by 20, and dividing the result by 10.

EXERCISE VII.

CALCULATION OF WOOL.

As the weights of wool vary in different places, we think it but justice to buyer and seller, to give the following table according to custom, with a few examples in each case, which will render the calculation familiar under any head :—

TABLE OF WEIGHTS.

General Weights.	*In some parts of England.*
7 pounds.....make..... 1 clove.	15 pounds.....make..... 1 stone.
2 cloves, or 14 lbs..... 1 stone.	2 stones, or 30 lbs..... 1 tod.
2 stones, or 28 lbs..... 1 tod.	8 tods, or 240 lbs. ..... 1 pack.
6½ tods..... 1 wey.	In Ireland, 16 lbs. ..... 1 stone.

And in some places, 14 lbs. make 1 stone.

PROBLEM 1.

Having the price per lb., to find the price per stone of 14 lbs.

1. GENERAL RULE.—Call the pence which 1 lb. costs shillings, and you have the price of 12 lbs.; for a stone of 14 lbs. add the $\frac{1}{6}$; for a stone of 15 lbs. add the $\frac{1}{4}$; and for a stone of 16 lbs. add the $\frac{1}{3}$; and you have the answer.

Reason.—In either of the above cases, when you call the pence shillings, you have the value of 12 lbs.; when you add the one-sixth, you have the amount of a stone of 14 lbs.; the one-fourth, the value of a stone of 15 lbs.; the one-third, the value of a stone of 16 lbs.

EXAMPLES OF 14 LBS.

1.—If a pound of wool cost 17d., what is the cost of a stone?

d.	s.	d.
17	= 17	0
$\frac{1}{6}$	2	10

Ans. 19s. 10d.

2.—If a pound cost 23½d., what will a stone come to? Ans. £1 7s. 5d.
3.—If a pound cost 3s. 9½d., what is a stone worth? Ans. £2 13s. 1d.
4.—If a pound cost 5s. 6½d., what will a stone come to? Ans. £3 17s. 3½d.

PROBLEM 2.

Having the price per lb., to know the price per stone of 15 *lbs.*

EXAMPLES OF 15 LBS.

5.—What will a stone of 15 lbs. come to, at 2s. 1¼d. per lb.?

s.	d.	£	s.	d.
2	1¼ =	1	5	9
One-fourth		0	6	5¼
Ans.		£1	12	2¼

6.—If 1 lb. cost 13¼d., what will a stone come to? Ans. 16s. 10¼d.
7.—If a lb. cost 2s. 7½d., what will 7 stones come to? Ans. £13 13s. 5½d.
8.—If a lb. cost 1s. 9½d., what will 9 stones come to? Ans. £12 1s. 10½d.

PROBLEM 3.

Having the price per lb., to find for a stone of 16 *lbs.*

EXAMPLES.

9.—What will a stone come to, at 2s. 5½d. per lb.?

s.	d.	£	s.	d.
2	5½ =	1	9	6
One-third		0	9	10
Ans.		£1	19	4

10.—If 1 lb. cost 17¼d., what cost a stone? Ans. £1 8s. 8d.
11.—If 1 lb. cost 13½d., what cost a stone? Ans. 18s.
12.—If 1 lb. cost 16¼d., what cost a stone? Ans. £1 1s. 8d.

NOTE.—A pack of wool contains 240 lbs.; a pack of 15 lbs. to the stone contains 16 stones; a pack of 16 lbs. to the stone, 15 stones: so by either pack, stone, or lb., you have the result instantaneously, at any proposed price per pack, per stone, or per lb.

PROBLEM 4.

By having the price of a lb., to know the amount per pack.

RULE 2.—Call the pence which a lb. costs pounds, the halfpenny ten shillings, and each farthing five shillings, and you have the amount per pack; then multiply by the number of packs, and you have the answer.

EXAMPLES.

13.—2 packs of wool, at 15¾d. per lb.? Ans. £31 10s.
14.—3 packs of wool, at 17¼d. per lb.? Ans. £51 15s.
15.—7 packs of wool, at 23¾d. per lb.? Ans. £166 5s.
16.—12 packs of wool, at 25¼d. per lb.? Ans. £309.

NOTE.—The calculation of feathers, bran, or barley, is the same, because each of these standards contain as many integers of its own denomination as a stone of wool contains pounds. When you estimate a stone of 16 lbs. at a pound, it will be 1s. 3d.; a stone of 15 lbs., 1s. 4d.; and a stone of 14 lbs., 1s. 5¼d.

EXERCISE VIII.

THE CALCULATION OF WHEAT.

PROBLEM 1.

Knowing the price of a bushel, coomb, or quarter, to find the price of any number of bushels, coombs, or quarters, at any proposed price.

RULE 1.—Reduce the price of the bushel, coomb, or quarter, to pence, and call it so many shillings; multiply these by the number you calculate for, according to rule 2nd, in page 76, and you have the amount.

EXAMPLES.

1.—18 bushels, at 5s. 4d. per bushel? Ans. £4 16s.
2.—26 bushels, at 4s. 10½d. per bushel? Ans. £6 6s. 9d.
3.—23 quarters, at £2 9s. 3d. per quarter? Ans. £56 12s. 9d.
4.—31 quarters, at £2 11s. 10d. per quarter? Ans. £80 6s. 10d.

NOTE.—A load of corn is 5 bushels, a cart-load 40 bushels, and a pint measure is supposed to contain 7922 wheat or barleycorns.

EXERCISE IX.

CALCULATION OF FLOUR.

PROBLEM 1.

To calculate for any number of stones or bags, at any price per stone, per bag, &c.

RULE 1.—Call the pence which a stone costs shillings, the shillings and pence which a bag costs pounds, then calculate on the general principle by the equations of 12 or 240, as the case may be.

EXAMPLES.

1.—13 stones of flour, at 1s. 3d. per stone? Ans. 16s. 3d.
2.—14 stones of flour, at 1s. 4d. per stone? Ans. 18s. 8d.
3.—20 sacks of flour, at 27s. 9d. per sack? Ans. £27 15s.
4.—30 sacks of flour, at 29s. 3d. per sack? Ans. £43 17s. 6d.
5.—60 sacks of flour, at 32s. 3d. per sack? Ans. £96 15s.
6.—80 sacks of flour, at 35s. 10d. per sack? Ans. £143 6s. 8d.

EXERCISE X.

THE CALCULATION OF OATS AND BARLEY.

PROBLEM 1.

To calculate the amount of any number of bushels or quarters of oats, or barley, at any price per bushel or quarter.

RULE 1.—Bring the price of one into pence, which call shillings, and multiply by the number of bushels or quarters for the result.

EXAMPLES.

1.—30 quarters of barley, at 27s. 9d. per quarter? Ans. £41 12s. 6d.
2.—23 quarters of barley, at 29s. 5d. per quarter? Ans. £33 16s. 9d.
3.—27 quarters of barley, at 31s. 9d. per quarter? Ans. £42 17s. 3d.
4.—37 quarters of barley, at 25s. 10d. per quarter? Ans. £47 15s. 10d.
5.—20 quarters of oats, at 33s. 9d. per quarter? Ans. £33 15s.
6.—33 quarters of oats, at 37s. 10d. per quarter?* Ans. £62 8s. 6d.

EXERCISE XI.

THE CALCULATION OF LAND.

PROBLEM 1.

By having the price of a perch, to know the rate per acre.

RULE 1.—Write the price of a perch in pence as pounds, and from it deduct its one-third; the remainder will be the amount of the acres in pounds.

EXAMPLE.

1.—At 15½d. per perch, what is that per acre?

	£	s.	
	15	15,	the amount of 240.
One-third,	5	5	
Ans.	£10	10,	the amount of 160 perches.

PROBLEM 2.

By having the price per perch, to know the value per rood.

RULE 2.—Call the pence which the perch costs pounds, and the one-sixth thereof will be the amount per rood.

* It may assist the corn dealer to know, for small quantities,—that 4s. a bushel is 1½d. a quart; 6s., 2¼d.; 8s., 3d.; being for every 8d. a bushel ¼d. per quart.

EXAMPLE.

2.—At 6d. per perch, what is that per rood?
÷¼) £6, the amount of 240.

Ans. £1, the amount of 40 perches, or a rood.

PROBLEM 3.

By having the price per acre, to know the amount per perch.

RULE 3.—To the price of the acre in pounds, add its half, and call the sum the price of the perch in pence.

EXAMPLE.

3.—At £6 per acre, what is that a perch?
£6
÷½) 3

Ans. 9d. per perch.

PROBLEM 4.

To reduce plantation to statute acres.

RULE 4.—Double the Irish acres, and from it take twice the double, keep two figures to the right; the one-hundred-and-twenty-first part of the remainder will be statute acres.

EXAMPLE.

4.—In 484 Irish acres, how many English?
968
1936
÷121) 94864

Ans. A. 784 English.

PROBLEM 5.

To reduce English to Irish acres, or statute to plantation.

RULE 5.—To five times the English acres, add twelve times the same, and keep a figure to the left; to that sum add its one-forty-ninth; divide the result by 1000, and you have the acres in plantation measure.

EXAMPLE.

5.—In 784 English acres, how many plantation acres?

3920
47040

474320
÷ 4½) 9680

÷1,000) 484.000 = 484 acres.

DIMENSIONS IN YARDS WHICH MAKE AN ACRE.

1 yard ... ... by 4840		11 yards ... ... by 440	
2 do. ... ... by 2420		20 do. ... ... by 242	
4 do. ... ... by 1210		22 do. ... ... by 220	
5 do. ... ... by 968		40 do. ... ... by 121	
8 do. ... ... by 605		44 do. ... ... by 110	
10 do. ... ... by 484		55 do. ... ... by 88	

PROBLEM 6.

To find the content of a piece of land in yards, feet, and inches.

RULE 6.—Reduce the yards and feet to feet; multiply the length by the width; divide the result by 9, and you have the content in yards and feet.

EXAMPLES.

6.—What is the content of a piece of ground 6 yards, 2 feet, 6 inches long, by 4 yards 2 feet broad?

yds.	ft.	in.		ft.	in.
6	2	6	=	20	6
4	2	0	=	14	

÷ 9) 287 0 feet.

yds. 31 8 feet.—Ans.

7.—What is the content of a plot of ground, 12 yards 1 foot, by 7 yards 2 feet broad? Ans. 94 yards 5 feet.

8.—If a garden be 45 yards 2 feet long, by 36½ broad, what does it measure in yards and feet. Ans. 1666 yards, 7 feet, 72 inches.

PROBLEM 7.

To reduce Irish miles to English, and English to Irish.

RULE 7.—To the Irish miles add four times the same, advancing a figure to the right; the one-eleventh of the sum will be English.

EXAMPLES.

9.—In 27 Irish miles how many English?

27
108

+11) 378

Ans. $34\frac{4}{11}$ English.

10.—In 75 Irish miles how many English? Ans. $95\frac{5}{11}$ m. Eng.

11.—Bring 120 Irish miles to English? Ans. $152\frac{8}{11}$ m. Eng.

12.—In 753 Irish miles how many English? Ans. $958\frac{4}{11}$ m. Eng.

REVERSE THIS RULE.

Multiply the English miles by 11, and divide by 14; you have the Irish miles.

EXAMPLES.

13.—In 40 English miles how many Irish?

40
11

÷14) 440

Ans. $31\frac{3}{7}$ Irish.

14.—In 95 English miles how many Irish?

95
11

÷14) 1045

Ans. $74\frac{2}{14}$ m. Irish.

15.—Bring 175 English miles to Irish?

175 × 11 = 1925 ÷ 14 = ... 137½m. Irish.

16.—In 654 English miles how many Irish?

654 × 11 = 1920 ÷ 14 = ... 516m. Irish.

17.—In 960 English miles how many Irish?

960 × 11 = 10560 ÷ 14 = ... 754⅐m. Irish.

18.—In 1000 English miles how many Irish?

1000 × 11 = 11000 ÷ 14 = ... 785⅐m. Irish.

EXERCISE XII.

NEW TABLE OF AVOIRDUPOIS WEIGHT, FROM ¼D. TO 3s. 6D. PER LB.: PER CWT.

℔ lb	℔ cwt.			℔ lb	℔ cwt.			℔ lb	℔ cwt.			℔ lb	℔ cwt.		
d.	£	s.	d.	d.	£	s.	d.	d.	£	s.	d.	d.	£	s.	d.
¼ is	0	2	4	6 is	2	16	0	11¼ is	5	9	8	20 is	9	6	8
½ ...	0	4	8	6½ ...	2	18	4	12 ...	5	12	0	21 ...	9	16	0
¾ ...	0	7	0	6¾ ...	3	0	8	12¼ ...	5	14	4	22 ...	10	5	4
1 ...	0	9	4	6¾ ...	3	3	0	12½ ...	5	16	8	23 ...	10	14	8
1¼ ...	0	11	8	7 ...	3	5	4	12¾ ...	5	19	0	24 ...	11	4	0
1½ ...	0	14	0	7¼ ...	3	7	8	13 ...	6	1	4	25 ...	11	13	4
1¾ ...	0	16	4	7½ ...	3	10	0	13¼ ...	6	3	8	26 ...	12	2	8
2 ...	0	18	8	7¾ ...	3	12	4	13½ ...	6	6	0	27 ...	12	12	0
2¼ ...	1	1	0	8 ...	3	14	8	13¾ ...	6	8	4	28 ...	13	1	4
2½ ...	1	3	4	8¼ ...	3	17	0	14 ...	6	10	8	29 ...	13	10	8
2¾ ...	1	5	8	8½ ...	3	19	4	14¼ ...	6	13	0	30 ...	14	0	0
3 ...	1	8	0	8¾ ...	4	1	8	14½ ...	6	15	4	31 ...	14	9	4
3¼ ...	1	10	4	9 ...	4	4	0	14¾ ...	6	17	8	32 ...	14	18	8
3½ ...	1	12	8	9¼ ...	4	6	4	15 ...	7	0	0	33 ...	15	8	0
3¾ ...	1	15	0	9½ ...	4	8	8	15¼ ...	7	4	8	34 ...	15	17	4
4 ...	1	17	4	9¾ ...	4	11	0	16 ...	7	9	4	35 ...	16	6	8
4¼ ...	1	19	8	10 ...	4	13	4	16½ ...	7	14	0	36 ...	16	16	0
4½ ...	2	2	0	10¼ ...	4	15	8	17 ...	7	18	8	37 ...	17	5	4
4¾ ...	2	4	4	10½ ...	4	18	0	17½ ...	8	3	4	38 ...	17	14	8
5 ...	2	6	8	10¾ ...	5	0	4	18 ...	8	8	0	39 ...	18	4	0
5¼ ...	2	9	0	11 ...	5	2	8	18½ ...	8	12	8	40 ...	18	13	4
5½ ...	2	11	4	11¼ ...	5	5	0	19 ...	8	17	4	41 ...	19	2	8
5¾ ...	2	13	8	11½ ...	5	7	4	19½ ...	9	2	0	42 ...	19	12	0

PROBLEM 1.

The price of a drachm in farthings, to find the value of lbs.

RULE 1.—Multiply the price of a drachm in farthings, by sixteen, and that product by the number of lbs.; double the first figure for shillings, then divide by six: the quotient will be pounds, shillings, and pence.

EXAMPLES.

1.—At 3¼d. the drachm, what cost 8 lbs.?

$$13 \times 16 \times 8 = 166\ 8 \div 6 = £27\ 14s.\ 8d.\ \text{Ans.}$$

2.—At 4½d. the drachm, what cost 68 lbs.? Ans. £326 8s.

PROBLEM 2.

To find the value of a lb., the price per ounce being given.

RULE 2.—If it be a pound avoirdupois, divide the farthings in the price per ounce by three, for the answer in shillings: if a pound troy, divide by four.

Reason.—By taking the farthings as shillings, is multiplying by 48 : now, ÷ 48 by 3 = 16 oz. in a pound avoirdupois ; ÷ 48 by 4 = 12 lb. troy.

EXAMPLES.

3.—1 lb. avoirdupois, at 5d. per ounce? Ans. 6s. 8d.
4.—1 lb. avoirdupois, at 7½d. per ounce? Ans. 10s.
5.—1 lb. avoirdupois, at 10¼d. per ounce? Ans. 14s. 4d.
6.—1 lb. troy, at 6¼d. per ounce? Ans. 6s. 9d.
7.—1 lb. troy, at 7½d. per ounce? Ans. 7s. 3d.
8.—1 lb. troy, at 11¼d. per ounce? Ans. 11s. 9d.

REVERSE THE ABOVE.

PROBLEM 3.

To find the value of an ounce, the price per lb. being given.

RULE 3.—If an ounce avoirdupois, take the shillings as farthings, and multiply by 3; if an ounce troy, multiply by 4: the answer will be pence.

Reason.—Taking the shillings as farthings, is equal to dividing by forty-eight, instead of sixteen; therefore, we multiply by three: for $16 \times 3 = 48$; and, in the case of troy weight, we multiply by four :—$12 \times 4 = 48$.

EXAMPLES.

9.—1 oz. avoirdupois, at 3s. per lb.? Ans. 2¼d.
10.—1 oz. avoirdupois, at 6s. per lb.? Ans. 4½d.
11.—1 oz. avoirdupois, at 9s. per lb.? Ans. 6¾d.
12.—1 oz. troy, at 2s. per lb.? Ans. 2d.
13.—1 oz. troy, at 6s. per lb.? Ans. 6d.
14.—1 oz. troy, at 9s. per lb.? Ans. 9d.

PROBLEM 4.

The value of any number of cwts. at pence per ounce.

RULE 4.—Multiply the pence per oz. by the cwts., and with the product considered as pence, take parts of 1792, (the number of ozs. in 112 lbs.,) the answer will be pounds sterling.

EXAMPLES.

15.—What will 6 cwts. come to, at 5d. per ounce?
$6 \times 5 = 30\text{d.} = 2\text{s. } 6\text{d.} = \frac{1}{8}$ of $1792 = £224$. Ans.
16.—What will 10 cwts. come to, at 4d. per oz.? Ans. £298 13s. 4d.
17.—What will 8 cwts. come to, at 3d. per oz.? Ans. £179 4s.
18.—What will 12 cwts. come to, at 4d. per oz.? Ans. £358 8s.

PROBLEM 5.

Having the price per pound in pence, to find the amount per quarter.

RULE 5.—Multiply two shillings and fourpence by the price of a pound in pence, for the price of the quarter.

EXAMPLE.

19.—At 4d. per pound, what is that per quarter or 28 lb.?

s. d.
2 4 × 4 = 9s. 4d. Ans.

PROBLEM 6.

The price of a lb. in pence, given to find the value of a ton.

RULE 6.—Take the shillings in the price of a cwt. as pounds, and for every fourpence add six shillings and eightpence.

EXAMPLES.

20.—1 ton, at 1d. per lb.? Ans. £9 6s. 8d.
21.—1 ton, at 3d. per lb.? Ans. £28.
22.—1 ton, at 2d. per lb.? Ans. £18 13s. 4d.
23.—1 ton, at 4d. per lb.? Ans. £37 6s. 8d.
24.—1 ton, at 5d. per lb.? Ans. £46 13s. 4d.
25.—1 ton, at 7d. per lb.? Ans. £65 6s. 8d.

PROBLEM 7.

The price of a lb. in farthings given, to find the value of a ton.

RULE 7.—Multiply the price of a lb. in farthings by seven, and divide by three for the answer in pounds.

EXAMPLES.

26.—If 1 lb. of iron cost 1¾d., what cost 1 ton?

1¾d. = 7 × 7 = 49
÷3)
Ans. £16 6s. 8d.

27.—If 1 lb. of iron cost 2¼d., what cost 1 ton? Ans. £23 6s. 8d.
28.—If 1 lb. of iron cost 2½d., what is it a ton? Ans. £25 13s. 4d.
29.—What will a ton come to, if 1 lb. cost 3¼d.? Ans. £32 13s. 4d.
30.—If 1 lb. cost 3¾d., what is a ton worth? Ans. £35.
31.—If 1 lb. of iron cost 4¼d., what is a ton worth? Ans. £39 13s. 4d.
32.—If 1 lb. cost 4½d., what is that a ton? Ans. £42.
33.—If 1 lb. of lead cost 4¾d., what is it per ton? Ans. £44 6s. 8d.

PROBLEM 8.

REVERSE OF THE FOREGOING RULE.

The price of a ton given, to find the value of a lb.

RULE 8.—Multiply the price of a ton by three, and divide by seven, you will have the answer in farthings.

EXAMPLES.

34.—If 1 ton of iron cost £16 6s. 8d., what is that a pound?

£ s. d.
16 6 8 × 3 = 49
÷7)
Ans. 7 = 1¾

35.—If 1 ton weight cost £23 6s. 8d., what is it per lb.? Ans. 2½d.
36.—If a ton of iron cost £39 13s. 4d., what is it per lb.? Ans. 4¼d.
37.—At £23 13s. 4d., the ton, what is it per lb.? Ans. $2\frac{1}{11}\frac{1}{4}$d.
38.—If 1 ton cost £42, what is that per lb.? Ans. 4¼d.
39.—If a ton cost £84, what is it per lb.? Ans. 9d.
40.—At £91 the ton, what is that per lb.? Ans. 9¾d.

PROBLEM 9.

To calculate the value of any number of tons at pence per cwt.

RULE 9.—Multiply the pence per cwt. by the tons, and $\frac{1}{12}$ of the product considered as pounds is the amount.

EXAMPLES.

41.—6 tons, at 2d. per cwt.?
$2 \times 6 = 12$
$\div \frac{1}{12}$) —
Ans. £1

42.—8 tons, at 3d. per cwt.?
$8 \times 3 = 24$
$\div \frac{1}{12}$) —
Ans. £2

43.—What will 9 tons come to, at 8d. per cwt.?
$8 \times 9 = 72$
$\div \frac{1}{12}$) —
£6 Ans.

44.—What will 10 tons come to, at 11d. per cwt.? Ans. £9 3s. 4d.
45.—24 tons, at 7½d. per cwt.? Ans. £15.
46.—36 tons, at 13½d. per cwt.? Ans. £40 10s.
47.—60 tons, at 19½d. per cwt.? Ans. £97 10s.

PROBLEM 10.

To calculate for cwts., qrs., stones, half stones, lbs., and ¼ lbs.; a shilling being the integer.

RULE 10.—Call the cwts. shillings; ¼, 9d.; ½, 6d.; ¼, 3d.; 14 lbs., 1½d.; 7 lbs., ¾d.; 1 lb., $2\frac{3}{8}$d.; ½ lb.; $5\frac{3}{8}$d.; ¼ lb., $1\frac{3}{1}\frac{}{2}$d. Then multiply by the number of shillings, take parts for the odd pence, and you have the result.

EXAMPLES.

48.—What will the carriage of 17 cwts. 3 qrs. 21 lbs. come to, at 3s. per cwt.?

cwts.	qrs.	lbs.
17	3	21

17s. 11¼d. × by 3 = £2 13s. 9¾d. Ans.

49.—What will the carriage of 15 cwts. 1 qr. 7 lbs. come to, at 7s. per cwt.? Ans. £5 7s. 2¼d.
50.—What will the carriage of 9 cwts. 3 qrs. 27 lbs. come to, at 9s. per cwt.? Ans. £4 9s. $11\frac{1}{2}\frac{1}{8}$d.
51.—What will the carriage of 13 cwts. 3 qrs. 15 lbs. come to, at 1s. 7d. per cwt.? Ans. £1 1s. $11\frac{5}{1}\frac{0}{2}$d.

PROBLEM 11.

To calculate for cwts. quarters, and pounds, at any price per cwt.; a pound the integer.

RULE 11.—Call the cwts. pounds, five times the quarters shillings, and two and the one-seventh times the pounds pence; it will be the amount at a pound: then take parts for the shillings and pence.

EXAMPLES.

52.—What is 13 cwt. 2 qrs. 14 lbs. of pork worth, at £1 6s. 8d. per cwt.?

	£	s.	d.	
	13	12	6	amount as per rule, at £1 per cwt.
One-third	4	10	10	amount at 6s. 8d.
Ans.	£18	3	4	

53.—What will 27 cwt. 2 qrs. come to, at £2 14s. 6d. per cwt.? Ans. £74 18s. 9d.

54.—Tell the price of 33 cwt. 1 qr. 14 lbs., at £1 15s. per cwt.? Ans. £58 8s. 1½d.

55.—If 1 cwt. cost £1 13s. 4d., what will 42 cwt. 1 qr. 20 lbs. come to? Ans. £70 14s. 3⅜d.

56.—What is 85 cwt. 1 qr. 10 lbs. worth, at £2 17s. 6d. per cwt.? Ans. £245 7s. 0½⅜d.

57.—At £4 15s. 6d. the cwt., what is 19 cwt. 3 qrs. 19 lbs. worth? Ans. £95 2s. 4⅝½d.

Reason.—You estimate the cwt. at a pound, and the quarter and pound proportionably.

PROBLEM 12.

To calculate for tons, cwts., qrs., and lbs.; a pound being the integer.

RULE 12.—Call the tons pounds; the cwts., shillings; ¼ cwt., 9d.; ½ cwt., 6d.; ¾ cwt., 3d.; 14 lb., 1½d.; 1 lb., $\frac{3}{28}$d. If more than a pound, multiply by the number of pounds, and take parts for the shillings and pence; if less than a pound, take parts for the shillings and pence out of the price at a pound.

EXAMPLES.

58.—12 tons 12 cwts. 3 qrs., at 6s. 8d. per ton?

t.	c.	q.		£	s.	d.	
12	12	3	=	12	12	9	at £1 per cwt.
+6s. 8d. = ⅓)							
				£4	4	9	Ans.

59.—16 tons 16 cwt. 3 qrs. 14 lbs., at 13s. 4d. per ton? Ans. £11 4s. 7d.

60.—27 tons 18 cwt. 2 qrs. 14 lbs., at 15s. per ton? Ans. £20 18s. 11½d.

61.—32 tons 12 cwt. 1 qr. 7 lbs., at 16s. per ton? Ans. £26 1s. 10½d.

62.—44 tons 14 cwt. 1 qr. 7 lbs., at 16s. 8d. per ton? Ans. £37 5s. 3⅜d.

63.—99 tons 9 cwt. 3 qrs., at 26s. 8d. per ton? Ans. £132 13s. 0d.

64.—56 tons 8 cwt. 2 qrs., at 22s. 6d. per ton? Ans. £63 9s. 6¾d.

65.—66 tons 6 cwt. 3 qrs., at 23s. 4d. per ton? Ans. £77 7s. 10½d.
66.—126 tons 11 cwt. 3 qrs. 14 lbs., at £12 per ton? Ans. £1519 2s. 6d.

CARRIAGE OF RAILWAY GOODS.

67.—What will the carriage of 7 tons 5 cwt. 3 qrs. 14 lbs. of goods per rail from London to Manchester come to, at 25s. 3d. per ton? Ans. £9 4s. $2\frac{1}{10}$d.

68.—What will the carriage of 9 tons 9 cwt. 1 qr. 16 lbs. of goods from York to Newcastle, per rail come to at 17s. 6d. per ton? Ans. £8 5s. 8⅛d.

69.—What will the carriage of 37 tons, 13 cwt. 2 qrs. 18 lbs. of goods come to per rail from Bristol to Liverpool at £1 13s. 10d. per ton? Ans. £63 14s. $11\frac{3}{11}\frac{5}{2}$d.

70.—What will the carriage of 43 tons 1 cwt. 1 qr. 1 lb. of goods per rail come to, from Paddington to Edinburgh, at £2 7s. 9d. the ton? Ans. £102 16s. $3\frac{1}{2}\frac{5}{2}\frac{2}{4}\frac{5}{0}$d.

71.—What will the carriage of 84 tons 3 cwt. 3 qrs. 20 lbs. of goods per rail, from Manchester to Aberdeen, come to at 52s. 9d. the ton? Ans. £222 1s. 4⅛d.

72.—Admit that 45 tons, 3 cwt. 3 qrs. 17 lbs. of goods were booked at Manchester for Edinburgh, at the rate of 1½d. per ton per mile, and the distance 272 miles: the Lancashire Company carries the goods 80 miles; York and Newcastle Company 76 miles; Newcastle and Berwick, 64 miles; Berwick and Edinburgh, 52 miles: what is the respective share of the amount due to each company?

EXPLANATION.

45 tons, 3 cwt. 3 qrs. 17 lbs., at 1½d. per ton per mile, is 4s. 8½d. (nearly) per mile.

Lancashire Company.....	80 miles,	at	4s. 8½d.	=	£18	16s.	8d.
York and Newcastle do. ...	76 do.	at	do.	=	17	17	10
Newcastle and Berwick do..	64 do.	at	do.	=	15	1	4
Berwick and Edinburgh do.	52 do.	at	do.	=	12	4	10

NOTE.—The above will be sufficient to show the railway clerk or goods manager how to calculate any quantity of goods at any price per ton per mile, and will be found useful in railway offices, either for goods or passengers, for any distance, no matter how many companies may be concerned: it will also be found useful for the clearance house.

EXERCISE XIII.

NEW RULE FOR SPIRIT MERCHANTS.

PROBLEM 1.

Having the price per gallon, to know the amount per hogshead.

RULE 1.—Take one-fifteenth of the farthings as pounds, from which deduct the cost of one gallon for the price per hogshead.

EXAMPLE.

1.—At 5s. 7¾d. per gallon, what is that per hogshead?—(63 gallons.)

5 7¾ = 271 farthings.

	£	s.	d.
One-fifteenth ÷ 271) =	18	1	4
		5	7¾
Ans.	£17	15	8¼

PROBLEM 2.

By knowing the price per glass, to know the cost per hogshead.

RULE 2.—Multiply four pounds four shillings by the price per glass in farthings for the cost per hogshead, and you have the answer in pounds and shillings.

EXAMPLE.

2.—At 1¼d. per glass, what is that per hogshead?

£ s.

4 4 × 6 = £25 4s. Ans.

PROBLEM 3.

By knowing the amount per hogshead, to find the price per glass.

RULE 3.—From the price of the hogshead in pounds, deduct its one-twenty-first part; the pounds that will remain will be one-fourth farthings per glass; and for every five shillings (if any), count the one-sixteenth of a farthing.

EXAMPLE.

3.—At £25 4s. per hogshead, what is that per glass?

	£	s.
÷ 1/21)	25	4
	1	4
÷4)	24	0 = 6 farthings = 1½d. per glass.

PROBLEM 4.

By knowing the price of a gallon, to find the price of a tun.

RULE 4.—To the price of a gallon in pence add one-twentieth of itself, and the sum will be the answer in pounds sterling.

EXAMPLES.

4.—If a gallon cost 6s. 3d., which will a tun* cost?

÷20) 75d.

3 15

Ans. £78 15s.

* 252 gallons make a tun.

5.—If 1 gallon of rum cost 14s. 9d., what is the price of a tun? Ans. £185 17s.

TO REVERSE THIS RULE.

From the price of the tun, subtract one-third of one-seventh of the price, and the remainder will be the price of a gallon in pence.

6.—If 1 tun cost £78 15s., what is that a gallon?

	£	s.
÷7)	78	15
÷3)	11	5
	3	15
	£75	0 and 75d. = 6s. 3d. per gallon.

EXERCISE XIV.

NEW METHOD OF TROY WEIGHT FOR CHEMISTS AND SILVERSMITHS.

PROBLEM 1.

Knowing the price per grain, to find the cost per ounce.

RULE 1.—The cost per grain in halfpence will be the price per ounce in pounds; and, *vice versa*, the cost per ounce in pounds will be the value of the grain in halfpence.

1.—At four halfpence per grain, it will be £4 per ounce; and at £4 per ounce, it will be four halfpence per grain.

PROBLEM 2.

Knowing the price per pennyweight, to find the amount of any number of pounds troy.

RULE 2.—Multiply the pounds weight by the price per pennyweight, and you have the answer in pounds sterling.

EXAMPLE.

2.—At 4d. per pennyweight, what will 80 lbs. cost? 80 × 4 = £320 Ans.

PROBLEM 3.

Having the price of an ounce, to find the value of any number of pounds, ounces, pennyweights, and grains.

RULE 3.—Reduce the pounds to ounces, which increase by the given ounces; then call the sum pounds, the pennyweights shillings, and half the grains pence, of which take such parts of the same as the price per ounce is of a pound.

EXAMPLE.

3.—At 5s. 6d. per ounce, what is the value of 10 lbs. 6 dwts. and 14 grains?

lbs.	dts.	qrs.		£	s.	d.
10	6	14	=	120	6	7
		5s. $\frac{1}{4}$)				
		6d. $\frac{1}{10}$)		30	1	$7\frac{1}{2}$
				3	0	$1\frac{1}{2}\frac{1}{0}$
				£33	1	$9\frac{1}{2}\frac{2}{0}$ Ans.

PROBLEM 4.

Having the price of an ounce, to know the value of any number of pounds.

RULE 4.—Multiply the pence per ounce by the number of lbs.; the product will be the answer in shillings.

EXAMPLE.

4.—At $4\frac{1}{2}$d. per ounce, what is the value of 7 lbs.?

$4\frac{1}{2}$d. × 7 = £1 11s. 6d. Ans.

PROBLEM 5.

By having the price of a dwt. in farthings, to find what one pound cost.

RULE 5.—Take $\frac{1}{4}$ of the price of a dwt. in farthings; the quotient will be the answer in pounds.

EXAMPLES.

5.—If one dwt. of silver cost $3\frac{1}{2}$d., what will 1 lb. cost?

÷ 4) 13 = £3 5s. Ans.

6.—If 1 dwt. of silver cost 5d., what will 1 lb. cost? Ans. £5.

7.—If 1 dwt. of silver cost $4\frac{3}{4}$d., what will 1 lb. cost? Ans. £4 15s.

PROBLEM 6.

If the quantity be any number of pounds.

RULE 6.—Multiply the price of a dwt. in farthings, by the given number of pounds; divide that product by 4 for the answer.

EXAMPLES.

8.—If 1 dwt. of silver cost $4\frac{3}{4}$d., what will 24 lbs. cost?

24 × 19 = 456 ÷ 4 = £114. Ans.

9.—If 1 dwt. cost 6¼d., what will 36 lbs. come to? Ans. £225.
10.—If 1 dwt. cost 7½d., what will 48 lbs. cost? Ans. £360.

EXERCISE XV.

TO CALCULATE THE VALUE OF A THOUSAND.

PROBLEM 1.

By having the price of one, to know the value of a thousand.

RULE 1.—Call the pence pounds, which multiply by four and the one-sixth for the answer.

Reason.—To multiply by four and one-sixth is evident; as four and one-sixth times 240 is 1000. Hence four and one-sixth will apply generally where the price of 1000 is required, the rate for one being given.

EXAMPLES.

1.—At 1¼d. per yard, what will 1000 yards cost?

£	s.	d.			£	s.	d.	
1	15	0	×	4⅙ =	7	5	10	Ans.

2.—1000 yards of broad cloth, at 7s. 9d. per yard? Ans. £387 10s.
3.—1000 yards of linen, at 2s. 7½d. per yard? Ans. £131 5s.
4.—1000 gallons of rum, at 14s. 7d. per gallon? Ans. £729 3s. 4d.

PROBLEM 2.

To reverse the above, when the price of the thousand is an integral number of pounds.

RULE 2.—From the price in pounds take four times said pounds, keeping the product two figures to the right of the units place; the remainder will be the farthings per integer, saving the last two digits, which will be centesimal parts of a farthing.

EXAMPLE.

5.—Suppose 1000 yards cost £25, what is that per yard?

£25
100

Ans. 24.00 farthings, or 6d. per yard.

EXERCISE XVI.

TABLE OF SALARIES, ETC., FROM £1 TO £150 PER ANNUM, REDUCED TO SO MUCH PER MONTH, PER WEEK, PER DIEM.

Y.	Pr. M.	Pr. W.	Pr. D.	Y.	Pr. M.	Pr. W.	Pr. D.	Y.	Pr. M.	Pr. W.	Pr. D.
£.	s. d.	s. d.	s. d.	£.	£. s. d.	s. d.	s. d.	£.	£. s. d.	£. s. d.	s. d.
1	1 8	0 4⅜	0 0⅜	11	0 18 4	4 2⅜	0 7⅛	30	2 10 0	0 11 6	1 7½
2	3 4	0 9¼	0 1¼	12	1 0 0	4 7½	0 8	40	3 6 8	0 15 4	2 2½
3	5 0	1 1⅞	0 2	13	1 1 8	4 11⅜	0 8¼	50	4 3 4	0 19 2¼	2 9
4	6 8	1 6⅛	0 2¾	14	1 3 4	5 4⅛	0 9¼	60	5 0 0	1 3 0¾	3 3⅛
5	8 4	1 11	0 3¼	15	1 5 0	5 9	0 10	70	5 16 8	1 6 10¾	3 10
6	10 0	2 3⅛	0 4	16	1 6 8	6 1⅜	0 10¾	80	6 13 4	1 10 8¾	4 4⅛
7	11 8	2 8¼	0 4¾	17	1 8 4	6 6¼	0 11⅜	90	7 10 0	1 14 6¾	4 11½
8	13 4	3 0⅜	0 5½	18	1 10 0	6 10⅜	0 11¾	100	8 6 8	1 18 4½	5 5½
9	15 0	3 5⅛	0 6	19	1 11 8	7 3⅛	1 0½	125	10 8 4	2 7 11⅛	6 10½
10	16 8	3 10	0 6⅛	20	1 13 4	7 8	1 1¼	150	12 10 0	2 17 6¾	8 2¾

PROBLEM 1.

Knowing the daily wages, to find the yearly salary.

RULE 1.—Call the pence pounds, to which add half thereof, and five days' wages: collect these items into one total for the answer.

EXAMPLE.

1.—At 15¼d. per day, what is the amount per annum?

£	s.	d.	
15	15	0	the amount of 240.
7	17	6	the amount of 120.
0	6	6¼	the wages of five days.
Ans. £23	19	0¼	

PROBLEM 2.

Having the yearly salary, to know the daily wages.

RULE 2.—Double the annual salary in pounds, the one-third thereof will be the price per day in pence: when the shillings are ten or more, to double the pounds, add one: but if less than ten, they are not to be taken into account. You are further to observe—if, after the division of three, one should remain, allow it a halfpenny; but if two remain, allow three farthings.

EXAMPLE.

2.—If a servant's wages be £23 19s. 0¼d. yearly, what is that per day?

£23 × 2 = 47 ÷ by 3 = ... ,,, 15¾d. Ans.

PROBLEM 3.

To find what any number of pence per day will amount to in a year.

RULE 3.—Take three hundred and sixty-five as pence; that is one pound, ten shillings, and five pence: multiply this by the number of pence per day.

Reason.—Because, £1 = 240d.; 10s. = 120d.; 4d. and 1d. = 5d.: 240 + 120 + 4 + 1 = 365.

EXAMPLES.

3.—365 days, at 5d. per day? Ans. £7 12s. 1d.
4.—365 days, at 7d. per day? Ans. £10 12s. 11d.
5.—365 days, at 9d. per day? Ans. £13 13s. 9d.
6.—365 days, at 10d. per day? Ans. £15 4s. 2d.
7.—365 days, at 16d. per day? Ans. £24 6s. 8d.
8.—365 days, at 18d¼. per day? Ans. £27 15s. 1¼d.*

PROBLEM 4.

What any number of pence per day will amount to in 313 days; the number of working days in a year, omitting Sundays, Christmas Day, and Good Friday.

RULE 4.—Multiply £1 6s. 1d. by the pence per day, and you have the yearly salary for 313 days.

Reason.—Because 313 pence equal £1 6s. 1d., as stated.

9.—313 days, at 2d. per day? Ans. £2 12s. 2d.
10.—313 days, at 5d. per day? Ans. £6 10s. 5d.
11.—313 days, at 6d. per day? Ans. £7 16s. 6d.
12.—313 days, at 7d. per day? Ans. £9 2s. 7d.
13.—313 days, at 13d. per day? Ans. £16 19s. 1d.
14.—313 days, at 14d. per day? Ans. £18 5s. 2d.

PROBLEM 5.

NOTE.—Should there be farthings in the rate per day, add 7s. 7¼d. for every farthing, for 365 days; and 6s. 6¼d. for 313 days.

Reason in both cases.—Because 7s. 7¼d. = 365 farthings; 6s. 6¼d. = 313 farthings.

15.—365 days, at 2¼d. per day? Ans. £3 8s. 5¼d.
16.—365 days, at 3¼d. per day? Ans. £4 18s. 10¼d.
17.—365 days, at 6¾d. per day? Ans. £9 17s. 8¾d.
18.—313 days, at 2¼d. per day? Ans. £2 18s. 8¼d.
19.—313 days, at 3¼d. per day? Ans. £4 4s. 9¼d.
20.—313 days, at 6¾d. per day? Ans. £8 9s. 6¾d.

* If farthings be in the price, add 7s. 7¼d. for 365 days.

PROBLEM 6.

To find what any number of shillings per week will amount to in a year.

RULE 5.—Add together two and a half times as many pounds, and twice as many shillings, as there are shillings per week.

EXPLANATION.

Thus,—6s. per week is £15 12s.; for twice six is £12; and half as many pounds is £3; and £12 × £3 12s. = £15 12s.

Reason.—Because, 52, the number of weeks in a year, is equal to 20 + 20 + 12 = 52.

21.—1 year, at 5s. per week? Ans. £13.
22.—1 year, at 6s. per week? Ans. £15 12s.
23.—1 year, at 8s. per week? Ans. £20 16s.
24.—1 yeaa, at 11s. per week? Ans. £28 12s.
25.—1 year, at 12s. per week? Ans. £31 4s.
26.—1 year, at 16s. per week? Ans. £41 12s.

EXERCISE XVI.

NEW METHOD OF EXTRACTING THE SQUARE ROOT.

PROBLEM 1.

A new and expeditious method for extracting the square root. By it any root may be extracted, biquadrate, sursolid, &c., &c.

RULE 1.—Divide the given number whose root is to be extracted, by some digit involved in the same power; divide the quotient by the latter divisor, or by a like power of some other digit; continue the division till one or some small insignificant remainder occurs, and choose, if possible, such divisors as the dividend will contain without a remainder. Then the required root taken off, the different divisors will be always rational, and these multiplied into each other, will be the true root if there be no remainder; but if a remainder occurs, place the root thus found drawn into the index of the power beneath the excess of the given number, whose root is to be extracted above the product of the respective divisors, which increment must be affixed to the rational root for the root of the required number, which will be found sufficiently correct for any practical purpose.

EXAMPLE.

1.—What is the square root of 144?

First, divide 144 by 16, and divide the quotient by 9; then, 16 and 9 are the divisors, whose root are 4 and 3; the product of these will be 12, which is the root required.

Next, if the number be irrational, as seven hundred and twenty, and its root be required, divide by nine, then by sixteen, and next by four; then nine, sixteen, and four, are the divisors, and one hundred and forty-four the remainder. Hence the root of the rational part of seven hundred and twenty-four, and its double placed beneath one hundred and forty-four. This fraction affixed to twenty-four, gives twenty-seven for the root, nearly.

2.—What is the square root of 3969? Ans. 63.
3.—Required the square root of 729? Ans. 27.
4.—What is the square root of 43264? Ans. 208.
5.—What is the square root of 50865424? Ans. 7132.
6.—What is the square root of ·00032754? Ans. ·01809+.
7.—What is the square root of 2·2710957? Ans. 1·50701+.

PROOF.—Square the root found, and to the product add the remainder, if any. If the work be right, the sum will be the same as the number to be extracted.

Squares :—	1,	4,	9,	16,	25,	36,	49,	64,	81.
Roots :—	1,	2,	3,	4,	5,	6,	7,	8,	9.

To square a number ending in 5.

RULE.—Multiply the number to the left hand of 5 by one greater; then annex 25 to the right, which will be the square of the number proposed.

EXAMPLES.

8.—Square 75.— × 7 by 8=56. Affix 25 to the right, thus 5625, which is the square of 75.

9.—Square 95.— × 9 by 10=90. Annex 25 and it will be thus 9025, the square of 90.

To square a number that ends with 1.

RULE.—To 10 times the square of the number, without the 1, add double that number; annex the sum, with 1, and you have the square of the number.

EXAMPLES.

10.—Square 41.—10 times the square of 4 is 160; 4×2=8; added to it make 168; to which prefix 1 = 1681, the square required.

11.—Square 91.—9 × 9 × 10=810; then add 9×2=18, make 828; to which annex 1, is 8281, the square.

CUBE ROOT.

RULE.—Point out the number given in periods of three figures each; find the nearest cube to the first period, then subtract, and put the root in the quotient: three times the square of the root will be the true divisor for the next. Multiply the figures found by three; join the product to the next root; multiply this number by the new root figure; place that product two figures to the right, under the trial divisor, to which add the same, and you have the true divisor.

PROOF.—Cube the root, and to the product add the remainder, and the sum will be the same as the number to be extracted.

Cubes :—	1,	8,	27,	64,	125,	216,	343,	512,	729.
Roots :—	1,	2,	3,	4,	5,	6,	7,	8,	9.

EXAMPLES.

12.—What is the cube root of 373248 ?

373248(27
343

$7^2 = 49 \times 3 \div 147)$ 302,48

7^2 or $49 \times 300 \times 2 =$	29400
$7 \times 30 \times 2^2$ or $4 =$	840
2^3 or $2 \times 2 \times 2 =$	8

302,48

Proof.

72
72
5184
72
373248 cube.

13.—What is the cube root of 48625125 ? Ans. 365.
14.—What is the cube root of 84604519 ? Ans. 439.
15.—What is the cube root of 259694072 ? Ans. 638.

EXERCISE XVII.

CALCULATION OF INTEREST.

PROBLEM 1.

To calculate interest for ninety-one, sixty-one, or thirty-one days, at five per cent. per annum.

RULE 1.—Take parts for the pence, divide it into the principal, and the quotient will be the answer in shillings and pence.

* 91 days is 3d. per pound ; 61 days is 2d. ; and 31 days 1d. (nearly.)

EXAMPLES.

1.—What is the interest on £137 for 91 days, at 5 per cent. ?

3d. $\div \frac{1}{4}$) 137

$\div 2,0)$ 3,4—3

Ans. £1 14 3

* As bills are frequently drawn for the above days, we give the nearest mercantile calculation a business man can claim,

2.—What is the interest on £233 for 61 days, at 5 per cent?
Ans. £1 18s. 10d.

3.—What is the interest on £1000 for 31 days, at 5 per cent?
Ans. £4 4s. 11d.

PROBLEM 2.

To calculate interest at five per cent. for days.

RULE 2.—Multiply either the money or the days by one-third of the money or the days; reject the unit's figure, and you have the answer in pence. Thus, the interest of £27 for 18 days: $27 \times 6 = 16$ (2= 16d.; or $18 \times 9 = 16$) 2=16d. interest.

EXAMPLES.

4.—Interest on £24 for 7 days, at 5 per cent? Ans. 5⅓d.
5.—Interest on £33 for 9 days, at 5 per cent? Ans. 9¾d.
6.—Interest on £41 for 12 days, at 5 per cent? Ans. 1s. 4⅓d.
7.—Interest on £76 for 6 days, at 5 per cent? Ans. 1s. 3⅛d.
8.—Interest on £85 for 15 days, at 5 per cent? Ans. 3s. $6\frac{5}{12}$d.
9.—Interest on £159 for 27 days, at 5 per cent? Ans. 11s. $11\frac{1}{12}$d.

PROBLEM 3.

To find the interest for days at any rate per cent.

A GENERAL RULE.—Multiply the principal by the days, and that sum by double the rate per cent. Cast off the units and tens; divide the figures to the left by 3; the quotient counts so many pence; deduct 1d. for every 6s.; the remainder will be the answer in pence.

EXAMPLES.

10.—What is the interest on £290 for 10 days, at 8 per cent.?

290
10
2900
6
÷3) 17400

s. d. d. s. d.
Ans. 58,00d. = 4 10—1 = 4 9

11.—Find the interest of £650 for 15 days, at 4 per cent.? Ans. £1 1s. 4⅓d.

12.—Calculate the interest on £370 for 40 days at 5 per cent.?
Ans. £2 0s. 6⅔d.

13.—What is the interest on £375 for 12 days, at 3½ per cent.?

375
12
4500
7
÷3) 31500

s. d. d. s. d.
Ans. 105d. = 8 9—1½ = 8 7½

14.—What is the interest on £280 for 60 days, at 6 per cent.?
Ans. £2 15s. 2¾d.

15.—Find the interest on £950 for 80 days, at 7 per cent.?
Ans. £14 5s. 11⅓d.

PROBLEM 4.

To find the interest of any sum for months at three per cent.

RULE 4.—Multiply $\frac{1}{40}$ of the principal by the months, and you have the answer in shillings.

EXAMPLES.

16.—What is the interest on £220 for eleven months, at 3 per cent.? $+\frac{1}{40}$) 220 = 11 × 11 = 121s. or £6 1s. Ans.
17.—What is the interest on £200 for 10 months, at 3 per cent.? Ans. £5.
18.—What is the interest on £180 for 9 months, at 3 per cent.? Ans. £4 1s.
19.—What is the interest on £160 for 8 months, at 3 per cent. Ans. £3 4s.
20.—What is the interest on £140 for 7 months, at 3 per cent.? Ans. £2 9s.
21.—What is the interest on £245 13s. 8d. for one month, at 3 per cent.? Ans. £12 5s. 8d.

NOTE.—The above will be found very useful in Savings' Banks.

PROBLEM 5.

To calculate interest at five per cent. for months.

RULE 5.—Write the pounds as pence, and multiply by the number of months for the answer in pence.

EXAMPLES.

22.—Interest on £4 for two months, at 5 per cent? Ans. 8d.
23.—Interest on £7 for three months, at 5 per cent? Ans. 1s. 9d.
24.—Interest on £9 10s. for three months, at 5 per cent? Ans. 2s. 4½d.
25.—Interest on £72 for nine months, at 5 per cent? Ans. £2 14s.
26.—Interest on £96 5s. for three months, at 5 per cent? Ans. £1 4s. 0¾d.
27.—Interest on £144 15s. for nine months, at 5 per cent? Ans. £5 8s. 6¾d.

PROBLEM 6.

To calculate interest upon any sum at five per cent. per annum.

RULE 6.—Reckon a shilling for every pound, and threepence for every five shillings.

EXAMPLES.

28.—Interest on £75, at 5 per cent? Ans. £3 15s.
29.—Interest on £110, at 5 per cent? Ans. £5 10s.
30.—Interest on £98, at 5 per cent? Ans. £4 18s.
31.—Interest on £26 5s., at 5 per cent? Ans. £1 6s. 3d.
32.—Interest on £47 10s., at 5 per cent? Ans. £2 7s. 6d.
33.—Interest on £69 15s., at 5 per cent? Ans. £3 9s. 9d.

PROBLEM 7.

To calculate interest at six per cent. for months.

RULE 7.—Multiply the pounds and months; cut off the unit figure of the product, and the remainder will be the interest in shillings. The figure cut off is tenths of a shilling. Thus the interest of £9 at 6 per cent., for 5 months, is $9 \times 5 = 4$ ($5 = 4\frac{5}{10}$s. = 4s. 6d.

EXAMPLES.

34.—Interest on £7 for three months, at 6 per cent? Ans. 2s. 1½d.
35.—Interest on £12 for four months, at 6 per cent? Ans. 4s. 9½d.
36.—Interest on £270 for seven months, at 6 per cent? Ans. £9 9s.
37.—Interest on £350 for eight months, at 6 per cent.? Ans. £14.
38.—Interest on £90 for eight months, at 6 per cent.? Ans. £3 12s.
39.—Interest on £380 for nine months, at 6 per cent.? Ans. £17 2s.

PROBLEM 8.

To find the interest for months at any rate per cent.

A GENERAL RULE.—Multiply the principal by the number of months, and that by double the rate; cut off the units figure, which will be so many tenths of 1d., and the figures to the left will be so many pence.

EXAMPLES.

40.—What is the interest on £36 for 3 months, at 2½ per cent.?

36
3
108
5
54,0d. = 4 6 Ans.

41.—Find the interest on £150 for 7 months, at 1¼ per cent.?
Ans. £1 1s. 10½d.

42.—What is the interest on £270 for 9 months, at 3¾ per cent.?
Ans. £7 11s. 10½d.

43.—Find the interest on £87 for 5 months, at 3¼ per cent.?

87
5
435
7½
3045
217½
326,2d. = £ 1 s. 7 d. 2½ Ans.

44.—Calculate the interest on £784 for 10 months, at 4 per cent.?
Ans. £26 2s. 8d.

45.—Tell the interest on £549 at 5 per cent. for 11 months?
Ans. £25 3s. 3d.

PROBLEM 9.

To find the interest on any sum at any rate per cent.

RULE 9.—Multiply time and rate, and divide the result into the principal, and you have the interest.

EXAMPLES.

46.—What is the interest of £991 3s. 3d. for $3\frac{1}{3}$ years, at 3 per cent. per annum?

$3\frac{1}{3}$
3
—
÷10) £ 991 s. 3 d. 3

Ans. £99 2 $3\frac{2}{10}$

47.—What is the interest on £765 12s. 7d. for 4 years, at $2\frac{1}{2}$ per cent. per annum? Ans. £76 11s. $3\frac{1}{2}$ or $\frac{1}{2}$d.

48.—What is the interest on £78 12s. 10d. for $12\frac{1}{2}$ years, at 1 per cent. per annum? Ans. £9 16s. $7\frac{1}{2}$d.

49.—Find the interest on £888 8s. 8d. for $3\frac{1}{4}$ years, at $3\frac{1}{4}$ per cent. per annum? Ans. £124 18s. $8\frac{3}{4}$d.

50.—What is the interest of £325 7s. 6d. for $3\frac{1}{3}$ years, at 6 per cent. per annum? Ans. £68 6s. $6\frac{1}{4}$d.

51.—At $5\frac{1}{4}$ per cent. per annum, what will the interest on £279 13s. 8d. amount to? Ans. £51 7s. 10d.

A GENERAL RULE.—Multiply the principal by double the rate, cut off the units figure, which will count so many pence and fifths of a penny, and the figures to the left will be so many shillings.

EXAMPLES.

52.—What is the interest on £27 at $2\frac{1}{2}$ per cent.?

27
5
—
13,5 = 13s. 6d. Ans.

53.—Tell the interest on £49 at $3\frac{1}{2}$ per cent.?

Ans. £1 11s. $10\frac{1}{2}$d.

54.—Calculate the interest on £84 at 4 per cent.?

Ans. £3 7s. $2\frac{2}{5}$d.

55.—Find the interest on £75 at 3 per cent.?

75
6
—
45,0 = £2, 5s. 0d. Ans.

56.—Find the interest on £75 at $3\frac{3}{4}$ per cent.?

Ans. £2 16s. 3d.

57.—What is the interest on £175 at 5 per cent.?

Ans. £8 15s. 0d.

EXERCISE XVIII.

TABLE OF COMMERCIAL DISCOUNT, SHOWING THE RATE PER CENT. ON A POUND AND A SHILLING, FROM $\frac{1}{8}$ TO 80 PER CENT.

Per cent.		In the £.			In the s.	Per cent.		In the £.			In the s.
$\frac{1}{8}$	is	0s.	$0\frac{3}{10}$d.		$_{2}\frac{3}{0}$0d.	$27\frac{1}{2}$	is	5s.	6d.		$3\frac{3}{10}$d.
$\frac{1}{4}$	...	0	$0\frac{3}{5}$	...	$_{1}\frac{3}{0}$0	$28\frac{3}{4}$	...	5	9	...	$3\frac{9}{20}$
$\frac{1}{2}$	...	0	$1\frac{1}{2}$	...	$_{5}\frac{3}{0}$	30	...	6	0	...	$3\frac{3}{5}$
$\frac{3}{4}$	...	0	$1\frac{4}{5}$	...	$_{1}\frac{9}{0}$0	$31\frac{1}{4}$	...	6	3	...	$3\frac{3}{4}$
1	...	0	$2\frac{2}{5}$	...	$_{5}\frac{6}{0}$	$32\frac{1}{2}$	...	6	6	...	$3\frac{9}{10}$
$1\frac{1}{4}$	...	0	3	...	$_{2}\frac{3}{0}$	$33\frac{3}{4}$	...	6	9	...	$4\frac{1}{20}$
$2\frac{1}{2}$	...	0	6	...	$_{1}\frac{3}{0}$	35	...	7	0	...	$4\frac{1}{5}$
$3\frac{3}{3}$	...	0	9	...	$_{2}\frac{9}{0}$	$36\frac{1}{4}$	...	7	3	...	$4\frac{7}{20}$
5	...	1	0	...	$\frac{3}{5}$	$37\frac{1}{2}$	...	7	6	...	$4\frac{1}{2}$
$6\frac{1}{4}$	...	1	3	...	$\frac{3}{4}$	$38\frac{3}{4}$	...	7	9	...	$4\frac{13}{20}$
$7\frac{1}{2}$	...	1	6	...	$_{1}\frac{9}{0}$	40	...	8	0	...	$4\frac{4}{5}$
$8\frac{3}{4}$	...	1	9	...	$1\frac{1}{20}$	$41\frac{1}{4}$	...	8	3	...	$4\frac{19}{20}$
10	...	2	0	...	$1\frac{1}{5}$	$42\frac{1}{2}$	...	8	6	...	$5\frac{1}{10}$
$11\frac{1}{4}$	...	2	3	...	$1\frac{7}{20}$	$43\frac{3}{4}$	...	8	9	...	$5\frac{1}{4}$
$12\frac{1}{2}$	...	2	6	...	$1\frac{1}{4}$	45	...	9	0	...	$5\frac{2}{5}$
$13\frac{3}{4}$	...	2	9	...	$1\frac{13}{20}$	$46\frac{1}{4}$	...	9	3	...	$5\frac{11}{20}$
15	...	3	0	...	$1\frac{3}{5}$	$47\frac{1}{2}$	...	9	6	...	$5\frac{7}{10}$
$16\frac{1}{4}$	...	3	3	...	$1\frac{19}{20}$	$48\frac{3}{4}$	...	9	9	...	$5\frac{17}{20}$
$17\frac{1}{2}$	...	3	6	...	$2\frac{1}{10}$	50	...	10	0	...	6
$18\frac{3}{4}$	...	3	9	...	$2\frac{1}{4}$	55	...	11	0	...	$6\frac{3}{5}$
20	...	4	0	...	$2\frac{2}{5}$	60	...	12	0	...	$7\frac{1}{5}$
$21\frac{1}{4}$	...	4	3	...	$2\frac{11}{20}$	65	...	13	0	...	$7\frac{4}{5}$
$22\frac{1}{2}$	...	4	6	...	$2\frac{7}{10}$	70	...	14	0	...	$8\frac{2}{5}$
$23\frac{3}{4}$	...	4	9	...	$2\frac{17}{20}$	75	...	15	0	...	9
25	...	5	0	...	3	80	...	16	0	...	$9\frac{3}{5}$
$26\frac{1}{4}$	...	5	3	...	$3\frac{3}{20}$						

NOTE.—The above calculation in the shillings is the nearest a mercantile man can obtain.

By having the discount on a pound or a shilling, (which the table shows,) you may easily find for any sum.

EXAMPLES.

1.—What is the discount on £7, at $18\frac{3}{4}$ per cent?

Opposite $18\frac{3}{4}$ per cent. is 3s. 9d. the discount on a £1.

$\times$ 3·9 by 7 = £1 6s. 3d. Ans.

2.—Find the discount on 11s., at 37½ per cent?
Opposite 37½ per cent, on a shilling is 4½d.
11

Ans. 4s. 1½d

PROBLEM 1.

When the discount is an aliquot part of £100.

RULE.—Take the parts of the principal with the given rate per cent. and you have the discount.

EXAMPLES.

3.—What is the discount on £666 6s. 6½d., at 50 per cent?

	£	s.	d.
÷½)	666	6	6½

Ans. £333 3 3¼ dis.

4.—Find the discount on £999 9s. 9d., at 33⅓d. per cent? Ans. £333 3s. 3d.
5.—Tell the discount on £762 16s., at 7½ per cent? Ans. £57 4s. 1½d.
6.—What is the discount on £765 18s. 4d., at 15 per cent? Ans. £114 17s. 9d.

A NEW METHOD FOR COMPUTING COMMISSION,

Brokerage, Premium of Insurance, Interest, Discount on Invoices or per centage, allowance for ready money, payments, &c.

RULE 1.—Multiply the given number of pounds by twice the rate per cent. Take the unit for pence and so many 5ths of a penny, and the remaining figures are the shillings.

EXAMPLES.

7.—What is the commission on £83, at 2 per cent?

£83
4

Ans. 33s. 2⅘d.

8.—What is the commission on £58, at 6¼ per cent?*
£58 × 12½ = 72,5 + 1 = 6 or 72s. 6d. Ans.
9.—What is the commission on £125, at 3¾ per cent?
£125 × 6¾ = 84,3 + 1 = 84s. 4⅗d. Ans.

* When the unit is more than 4, and when the shillings produced by the multiplication are more than 5, then add one penny to the result for each unit and fraction.

EXERCISE XIX.

ARREARS AND ANNUITIES AT SIMPLE INTEREST.

PROBLEM 1.

The annuity, rate per cent., and time given, to find the amount.

RULE 1.—Multiply the rent, or annuity, by the time; then multiply the rate by the time, less one, with half the product into the product. Add such part or parts to the reserved product: the result is the amount.

EXAMPLES.

1.—If the yearly rent of £45 remain unpaid for five years, at 5 per cent. per annum, what will it amount to?

	£
$45 \times 5 =$	225
$4 \times 5 = 20 = 10 + 22$	10
Ans.	£247 10

2.—What will an annuity of £120 amount to, suppose it to be forborne for six years, at 5 per cent. per annum? Ans. £810.

3.—What will a pension of £75 amount to, if it be forborne for twenty-one years, at 2 per cent. per annum? Ans. £1890.

PROBLEM 2.

The amount, rate per cent., and time given, to find the annuity.

RULE 2.—Divide the amount by the time, reserve the quotient, then multiply the rate per cent. by the time, less one; take half of the product; consider what part of 100 half the product is; add the numerator and denominator of the fractional part of 100, and with their sum take part or parts of the reserved quotient, which part subtract from the quotient, and you have the amount.

EXAMPLES.

4.—If a yearly rent, forborne for five years, at 5 per cent. per annum, amounts to £247 10s., how much was the rent?

	£	s.
÷5)	247	10
÷11)	49	10
	4	10
Ans.	£45	0

5.—If an annuity amount to £810 in six years, at 5 per cent. per annum, what was the annuity? Ans. £120.

6.—If a yearly pension amounted to £3,300 in eleven years, at 4 per cent. per annum, how much was the pension? Ans. £250.

7.—If the amount of a yearly salary, payable half-yearly, be £884 7s. 6d. in five years, at 5 per cent. per annum, what is the yearly salary? Ans. £150.

EXERCISE XX.

THE PURCHASING OF PROPERTY AND FREEHOLD ESTATES.

PROBLEM 1.

To find what rate per cent. money may be laid out in purchasing property

RULE 1.—Divide 100 by the number of years' purchase, and you have the per centage.

EXAMPLES.

1.—If you purchase an estate worth £100 a year, and give 13 years' purchase, what per cent. have you for your outlay? 100 ÷ by 13 = £7 13s. $10\frac{3}{13}$d. per cent. Ans.

2.—Gave 14 years' purchase for a rental of £170 a year; what per cent. have I for my money? Ans. £7 2s. $10\frac{2}{7}$d. per cent.

3.—If you give 21 years' purchase for a property, which brings in £190 per annum, what per cent. have you for your money? Ans. £4 15s. $2\frac{2}{7}$d. per cent.

PROBLEM 2.

The purchase money and rate per cent. given, to find the yearly rent.

RULE 2.—Divide the purchase money by that part which the rate is of 100, and you have the yearly rent.

EXAMPLES.

4.—If an estate be sold for £11,000, what must be the yearly rent to allow the buyer 5 per cent. per annum?

	£
$5 = \div \frac{1}{20}$)	11000
Ans.	£550

5.—If a freehold be sold for £30,000, what must be the yearly rent to allow the purchaser 4 per cent. per annum? Ans. £1200.

PROBLEM 3.

The yearly rent and purchase money given, to find the rate per cent.

RULE 3.—Divide the purchase money by the yearly rent; 100 divided by the quotient will give the rate per cent.

EXAMPLES.

6.—If an estate of £550 be bought for £11,000, at what rate per cent. is the money laid out?

£
÷550) 11000

20 ÷ 100 = 5 per cent. Ans.

7.—If an estate of £1200 a year is bought for £30,000, at what rate per cent. is the money laid out? Ans. 4 per cent.

EXERCISE XXI.

PROFIT AND LOSS.—NEW RULES.

PROBLEM 1.

Given the whole profit and rate per cent., to find the prime cost.

RULE 1.—Multiply the gain by that part which the given rate is of 100, and you have the prime cost or purchase money.

EXAMPLES.

1.—If by selling goods at 2½ per cent. profit I clear £13, what did the goods cost me?

£13
$2\frac{1}{2} = \frac{1}{40}$ of 100 × 40

Ans. £520

2.—If by selling tea at 5 per cent. profit I clear £19 19s., what did the tea cost me? Ans. £399.

3.—If by selling sheep at 12½ per cent. profit I clear £27, how much have I paid for the sheep? 27 × 8 = £216. Ans.

PROBLEM 2.

The whole gain and rate per cent. given, to find the selling price.

RULE 2.—Find what part the rate is of 100; add the numerator of the fraction to its denominator, and by their sum multiply the whole gain, which will give the selling price.

EXAMPLES.

4.—If by selling goods at 12½ per cent. I clear £14, how much did I receive? $12\frac{1}{2} = \frac{1}{8} \times = 9 \times 14 = £126$. Ans.

5.—If by selling tobacco at 20 per cent. profit I clear £99, how much have I received for it? Ans. £594.

6.—If by selling timber at 25 per cent. profit I clear £77, how much have I received for it? Ans. £385.

PROBLEM 3.

The whole loss and rate per cent. given, to find the selling price.

RULE 3.—Find what part the rate is of 100; from the denominator of the fraction subtract the numerator, and multiply the loss by the difference.

EXAMPLES.

7.—By selling goods at 20 per cent. loss, I lose £25; how much have I received? $20 = \frac{1}{5}$.— $= 4 \times 25 = £100$. Ans.

8.—By selling goods at 25 per cent. loss, I lose £16; how much have I received? Ans. £48.

9.—By selling cotton at 10 per cent. loss, I lose £1234; how much have I received for it? Ans. £11,106.

10.—By selling wool at 33⅓ per cent. loss, I lose £77; how much have I received for it? Ans. £154.

PROBLEM 4.

The first cost and selling price being given, to find the gain per cent.

RULE 4.—Subtract the first cost from the selling price: divide the cost by their difference, and 100 divided by the quotient will give the rate per cent. gain.

EXAMPLES.

11.—If I buy a horse for £15, and sell it for £17 10s., what is the gain per cent?

£17	10s.
15	0
£2	10

2 10 in 15 = 6 in 100 = 16⅔ per cent. Ans.

12.—Bought a yard of broad cloth at 6s., and sold it for 7s.; what was the gain per cent.? Ans. 16⅔d. per cent.

13.—If I buy tea at 6s. per lb., and sell it at 6s. 8d., what will I gain per cent.? Ans. 11⅑ per cent.

14.—Bought linen at 12d. per yard, add sold it at 13½d.; what is the gain per cent.? Ans. 12½ per cent.

15.—If I buy broad cloth at 13s. 4d. per yard, and sell it at 20s., what do I gain per cent.? Ans. 50 per cent.

16.—Bought tobacco at 3s. per lb., and sold it at 3s. 4d., what is the gain per cent.? Ans. 11⅑ per cent.

PROBLEM 5.

The first cost and rate per cent. given to find the selling price.

RULE 5.—Divide the prime cost by that part which the rate is of 100; add the quotient to the first cost, and you have the selling price.

EXAMPLES.

17.—Bought a quantity of cotton for £12345; how must I sell it to gain 5 per cent.?

	£
5 = ÷ $\frac{1}{20}$	12345
	617 5
Ans.	£12962 5

18.—Bought a yard of cloth for 6s.; how must I sell it to gain 16⅔ per cent.? Ans. 7s.

19.—Bought a quantity of sugar for £22 13s. 6d.; how must I sell it to gain $9\frac{1}{11}$ per cent.? Ans. £24 14s. $8\frac{8}{11}$d. per cent.

20.—Bought a horse for £14; how must I sell it to gain 14¼ per cent.? Ans. £16.

21.—Bought tobacco at 3s. per lb.; how must I sell it per lb. to gain $11\frac{1}{9}$ per cent.? Ans. 3s. 4d.

PROBLEM 6.

The cost of the whole, with the retail price given, to find the profit or loss.

RULE 6.—Find the first cost from the retail price. If the selling price be more than the prime cost, you have gained; but if less, you have lost so much.

EXAMPLES.

22.—Bought 20 yards of cloth for £19, and sold it at 18s. 4d. per yard; did I gain or lose? Ans. 13s. 4d. loss.

23.—Bought 60 lbs. of tea for £22, which I retailed at 7s. 8d. per lb.; tell me the gain or loss? Ans. £1 gain.

24.—Bought 40 yards of cloth for £33, and sold it for 17s. per yard; tell me the gain or loss? Ans. £1 gain.

25.—Bought 140 gallons of gin for £63, I retailed the same at 9s. 6d. per gallon; tell me the gain or loss? Ans. £3 10s. gain.

26.—Bought 220 gallons of rum for £176; sold it immediately at 16s. per gallon; how much have I gained or lost?

	s.	£	
220 @	16	= 176	sold.
—		176	bought.

Neither gain nor loss.

EXERCISE XXII.

SUPPOSITION.

RULE 1.—As the result from the supposition is to the true result, so is the supposed number to the number required.

EXAMPLES.

1.—A man being asked how many shillings he had in his pocket, said, "If I had as many, half as many, and a ¼ as many more, I would have 66s.;" how many had he? Suppose 4

4
2
1

÷11) 66=6×4=24 Ans.

2.—If by selling goods for £40 I gained ¼ of what they cost, how much did they cost me? Ans. £32.

3.—Sold goods for £25 and lost ⅕ of which they cost me, how much did I pay for them? Ans. £30.

4.—A person being asked how many pence he had, said, "If the third, fourth, and sixth of the number were added, they would make 63:" how many had he? Ans. 84.

5.—Joe asked James how many marbles he had? James said, "If I had as many, twice as many, and three times as many more, I should have 42:" how many marbles had James? Ans. 6.

6.—Sold a quantity of broad cloth for £72, and gained ⅜ of what it cost me; how much did I pay for it? Ans. £45.

7.—Three wheels are to make 180 revolutions, the second to make 2 for the first 1, and the third to make 3 for the second 1; how many revolutions did each make? Suppose 1÷9) 180=20×1= 20 first.

2 — 20×2= 40 second.
6 20×6=120 third.

Ans. 9

EXERCISE XXIII.

THE SLIDING RULE.

The sliding rule is a kind of logarithmic table, and is so constructed as to obtain the solution of arithmetical questions in either multiplication, division, or extraction of the roots of numbers. It is formed of two pieces of box-wood, each 12

inches in length, joined together by a brass folding joint. In one of the pieces there is a brass slider. The rules are commonly marked with A on the rule, B and C on the slider, and D on the girt or square line. Let the learner observe whatever value is given to the first 1 from the left, the numbers following, viz. :—2, 3, 4, 5, &c., will represent twice thrice, four times, &c., that value. If one is reckoned one or unity, the rest will count 2, 3, 4, &c.; but if the one is reckoned ten, then 2, 3, 4, will count 20, 30, 40. Should the first one be called 100, then 2, 3, 4, &c., will count 200, 300, 400, &c. The value of the one in the middle of the line is always ten times that of the first one; the value of the second 2 is ten times that of the first 2; so that if the value of the first 1 be 10, that of the second 1 will be 100; the first 2 will be 20, and the second 2 will be 200, &c. On the lines A, B, and C, there are 50 small divisions betwixt 1 and 2, 2 and 3, 3 and 4, &c. Now, if the first 1 be reckoned 1 or unity, each of the small divisions between 1 and 2, and 2 and 3, &c., will be $\frac{1}{50}$ or ·02; and if you take the first 1 to be unity, then the small divisions from the second 1 to 2, 2 to 3, &c., will each be ten times greater then $\frac{1}{50}$, or ·02, each of them will be $\frac{10}{50}$ or $\frac{1}{5}$ or ·2. Again if 1 represents 100, the first 2 will be 200; if the second 1 be 1000, the second 2 will be 2000, and so on. The above being well understood, we shall now proceed to the use of the rule.

PROBLEM 1.

To multiply by the sliding scale.

RULE 1.—Set one on B to one of the factors on A; next against the factor on B, you have the product on A.

EXAMPLES.

1.—Find the product of 3 bp 8?

DIRECTION.—Set 1 on B to 3 on A; then against 8 on B will be found the product 24 on A.

2.—Find the product of 24 by 16?

DIRECTION.—Set 1 on B against 16 on A; then look on B for 34, and against it on the line A will be found the product 544.

PROBLEM 2.

To divide by the sliding rule.

RULE 2.—Set the divisor on B to the dividend on A: against 1 on B you have the quotient on A.

EXAMPLES.

3.—Find the quotient of 96 divided by 6?—

DIRECTION.—Move the slider till 1 on B stands against 6 on A; then the quotient 16 will be found on B, against the dividend 96 on A.

4.—What is the quotient of 108 divided by 12?

DIRECTION.—Set 12 on B against 1 on A; on the line A will be found the quotient 9 against 108 on B.

PROBLEM 3.

Proportion by the sliding rule.

RULE 3.—Set the first term on the slider B to the second on A; then on the line A will be found the fourth term standing against the third term on B.

EXAMPLE.

5.—If 4 lbs. of brass cost 36d., what will 12lbs. come to?

DIRECTION.—Move the slider so that 4 on B will stand against 12 on A; then against 36 on B will be found the fourth term 108 on A.

PROBLEM 4.

Superficial measure by the sliding rule.

RULE 4.—Multiply the length by the breadth, the product will be the area.

DIRECTION.—Set 12 on B against the breadth in inches on A: on the line A will be found the surface in square feet against the length in feet on the line B.

EXAMPLE.

6.—What is the content of a plank 18 in. broad, and 10 feet 3 in. long.

DIRECTION.—Move the slider so that 12 on B stands against 18 on A; then will $10\frac{1}{4}$ on B stand against $15\frac{3}{4}$ on A, which is $15\frac{3}{4}$ square feet.

PROBLEM 5.

To find the solid content of timber by the sliding rule.

RULE 5.—Multiply the length, breadth, and thickness together.

Set the length in feet on C to 12 on D, then on C will be found the content in feet against the square root of the product of the depth and breadth in inches on D.

EXAMPLE.

7.—What is the content of a square log of timber, the length of which is 10 feet, and the side of its square base 15 inches.

Set 10 on C against 12 on D; then will 15 on D stand against the content $15\frac{1}{2}$ on C.

PROBLEM 6.

To extract the square root by the sliding rule.

Move the slider so that the middle division on C, which is marked 1, stands against 10 on the line D; then against the given number on C. the square root will be found on D.

NOTE.—If the given number consists of an even number of places of figures, as 2, 4, 6, &c., it is to be found on the left hand part of the line C; but if odd numbers, as 3, 5, 7, &c., it is to be found on the right hand side of C, one being the middle point of the line.

EXAMPLES.

8.—Find the square root of 81?

The number of places are even, being two; therefore the number 81 is sought for on the left hand side of the line C. Set 1 on C against 10 on D; then against 81 on C will be found 9. the square root on D.

9.—What is the square root of 144?

Set 1 on C to 10 on D; then against 144 on C will be found the square root 12 on D.

EXERCISE XXIV.

TIMBER TABLE STANDARD MEASURE.

1728 cubical inches	make	1 cubical foot.
144 square inches		1 square foot.
50 feet solid round timber		1 ton
40 feet solid square timber		1 ton.
1 cubical yard		27 cubical feet.

A load of rough timber=40 cubic feet; a load of square timber=50 cubic feet; a ton of shipping=40 cubic feet; a floor of earth=324 cubic feet: a cord of wood, 8 feet long, 4 feet broad, and 4 feet deep=128 cubic feet; a stack of wood, 12 feet long, 3 feet broad, and 3 feet deep=108 cubic feet; a solid yard of earth=1 load.

600 sqr. feet of plank, 1 in. thick=1 load; 400 sqr. feet, 1½ in. thick=1 load; 300 sqr. feet, 2 in. thick=1 load: 200 sqr. feet, 3 in. thick=1 load; 150 sqr. feet, 4 in. thick=1 load; Russian standard, 12 feet long, 1½ in. thick, 11 in. broad; Swedish standard, 14 feet long, 3 in. thick, 10 in. broad; Norwegian standard, 12 feet long, 3 in. thick, and 9 in. broad. The above are the standard rates in London.

SUPERFICIAL MEASURE.

PROBLEM 1.

To find the area or superficial content of a board or plank.

RULE 1.—Multiply the length by the breadth, the product will be the content. When the board is tapering, add both ends together, and half the sum will be the mean breadth; then multiply the mean breadth by the length, the product will be the superficial content.

EXAMPLES.

1.—In a board 12 feet long and 8½ inches broad, how many feet? Ans. 8 feet 6 inches.
2.—What is the content of a plank 14 inches broad, and 16 feet 6 inches long? Ans. 19 feet 3 inches.
3.—In a board 15 feet 6 inches long and 10 inches broad, how many feet? Ans. 12 feet 11 inches.
4.—Find the content of a plank 20¼ feet long and 12½ inches broad? Ans. 21 ft. 7 in. 4 sec. 6th.

PROBLEM 2.

When length, breadth, and depth are given, the length being feet, and the breadth and depth inches.

RULE 2.—Multiply the breadth by the depth; $\frac{1}{12}$ of the product multiplied by the length will give the measure in feet.

EXAMPLES.

5.—How many square feet are there in a plank 16 feet long, 9 inches broad, and 4 inches thick? $16 \times 3 = 48$ feet Ans.
6.—How many square feet are there in a plank 21 feet long, 18 inches broad, and 3½ inches thick? $21 \times 5 = 105$ feet Ans.
7.—In five planks, each 15 feet long, 8 inches broad, and 3 inches thick, how many feet? $15 \times 10 = 150$ feet Ans.
8.—In twelve planks, each 11 feet long, 9 inches broad, and 4 inches thick, how many feet? $132 \times 3 = 396$ feet Ans.

SUPERFICIAL MEASURE IN YARDS, FEET, AND INCHES.

PROBLEM 3.

RULE 3.—If the measure be required in any other name greater than feet, first find it in feet, and then bring them to the denomination required.

EXAMPLE.

9.—What is the content of a piece of ground 6 yards 2 feet 6 inches long, and 4 yards 2 feet broad?

	yds.	ft.	in.		ft.	in.
Length,	6	2	6	=	20	6
Breadth,	4	2	0	=	14	
				+9)	287	
				Ans.	31 yds. 8 ft.	

10.—What is the content of a piece of land 12 yards 1 foot long, 7 yards 2 feet broad? Ans. 94 yds. 5 ft.

11.—What is the content of a garden 45 yards 2 feet long, 36½ yards broad? Ans. 1665 yds. 7 ft. 6 in.

12.—How many yards in a carpet, 7 yards 1 foot 4 inches long, 5 yards 2 feet 3 inches broad? Ans. 42 yds. 9 ft. 8 in.

13.—What is the content of a floor, 13 yards 2 feet 9 inches long, 5 yards 1 foot 7 inches broad? Ans. 76 yds. 11 ft. 5 in.

SOLID MEASURE IN YARDS, FEET, AND INCHES.

PROBLEM 4.

RULE 4.—Solid measure may be computed like superficial, by duodecimals.

EXAMPLES.

14.—What are the solid contents of a wall, 13 feet 6 inches long, 5 feet 8 inches high, and 2 feet, 7 inches broad?

$\times$ length 13.6 by $5.8 = 67.6 \times 2.7 = 197$ ft. 7 ins. 6 pts. Ans.

15.—What are the contents of a cistern, 9 yards 2 feet long, 6 yards 2 feet broad, and 4 yards 2 feet deep? Ans. 300 yards 20 feet.

16.—What are the contents of a rampart, 154 fathoms 2 feet long, 6 fathoms 4 feet broad, and 3 fathoms 5 feet high? Ans. 3944 fathoms 16 ft.

17.—What are the contents of a box, 6 feet 2 inches long, 3 feet 5 inches broad, and 2 feet 9 inches and 5 parts deep? Ans. 47 ft. 8 in. 2 pts. $11'' 2'''$

18.—What is the solid measurement of a bale of goods, 3 feet 2 inches long, 2 feet 7 inches broad, and 11 inches deep? Ans. 7ft. 5in. 11pts. 10s.

PROBLEM 5.

To find the solidity of square or four-sided timber.

RULE 5.—Multiply the mean breadth by the mean thickness, and the result by the length for the solidity. If the tree throughout be equally broad and thick, the breadth and thickness, anywhere taken, will be the mean breadth and thickness; but if it tapers regularly from one end to the other, the breadth and thickness taken in the middle, will be the mean breadth and thickness. If the tree does not regularly taper, but in some places is thicker than others, find the content of each part separately.

EXAMPLES.

19.—How many solid feet in a piece of timber, 12 feet long, 3 feet broad, and 2 feet thick? Ans. 72 feet.

20.—Required the solid content of a tree, 16 feet long, and 14 inches the side of the square? Ans. 21 ft. 9 in. 4 sec.

21.—What is the solid content of a tree, 14 feet long, and 10½ inches the side of the square? Ans. 10 ft. 8 in. 7 sec. 6th.

22.—What is the solid content of another tree, 24 feet 6 inches long, and 20 inches the side of the square? Ans. 68 ft. 8 sec.

23.—If a piece of timber be 18½ feet long, 14 inches broad, and 9 inches deep, what is the solid content? Ans. 16 feet. 2 in. 3 sec.

24.—What is the solid content of a piece of timber or stone, whose sides are 10 inches by 18, and the length 18 feet? Ans. 22 ft. 6 in.

PROBLEM 6.

To find the solidity of unsquared or round timber.

RULE 6.—Multiply the square by the square in inches, &c., and that product by the length in feet, &c.; divide that product by 144, and you will have the solid feet. If any should remain, divide by 12 for inches.

EXAMPLES.

25.—Admit a piece 20½ feet long, by 10½ inches square, (which is a quarter of the line contained round the same): required the solid content in feet?

×10·25 by 10·25=10506·25×20·5=2153(78-12-5+by 144= 14 ft. 11 in. Ans.

26.—What is the solid content of a round tree, 25 feet long, and girt in the middle 45 inches? Ans. 2I ft. 11 in. 8 sec. 9 fths.

27.—How much timber in a round tree, 30 feet long, and the girt 42 inches? Ans. 22 ft. 11 in. 7 sec. 6 fths.

PROBLEM 7.

A more accurate way is to multiply the square of one-fifth of the girt by twice the length for the solidity.

28.—If the length of a tree is 24 feet, and the girt 8 feet, what is the content? Ans. 122·88 ft.

29.—The girts of a tree in five different places, are 9·43 feet, 7·03 feet, 6·15 feet, 4·74 feet, and 3·16 feet, and the length 17½ feet; what is the solidity? Ans. 54·424992 feet.

NOTE.—Take care to point off your decimal parts.

·25 is the decimal of ¼

·50 is the decimal of ½

·75 is the decimal of ¾ of anything.

PROBLEM 8.

Unequal-sided timber.

RULE 7.—Multiply breadth and thickness together in inches and half inches, and that product by the length in feet, which, divided by 144, cutting off so many decimal figures as there are in the operation, the content will appear in solid feet; the remainder, divided by 12, gives inches.

EXAMPLE.

30.—A piece of timber 26½ feet long, 18½ inches broad, and 14½ inches thick, how many solid feet?

× 18·5 by 15·5 = 2682·5 × 26·5 = 7108·625 ÷ by 144 =
Ans. 49 ft. 4 in. 4 pts. solid.

PROBLEM 9.

To find the content of triangular timber.

RULE 8.—Multiply the base by the perpendicular in inches, and half that product by the length in feet; divide the result by 144; it will then give the number of solid feet. Divide the remainder by twelve for the inches.

EXAMPLE.

31.—In a piece of timber, whose sides are triangular, viz.,—the base 29 in., perpendicular 17½ inches, and the length 12 feet; how many solid feet contained?

× 26 by 17½ = 455, ½ of = 227½ × by 11 = 2730 ÷ by 144 =
18 ft. 11 in. 6 pts. solid. Ans.

PROBLEM 10.

Mahogany.

RULE 9.—Multiply breadth by depth in inches, and that product by the length in feet, which last product, divided by 12, gives the superficial inch-feet required.

EXAMPLE.

32.—In a mahogany log 25½ inches broad, 16 inches thick, and 15½ feet long, how many superficial inch-feet?

× 25½ by 16 = 408 × 15½ = 6324 ÷ 12 = 527 inch-feet. Ans.

33.—In a log, 33 inches broad, 19 inches thick, and 23½ feet long, how many superficial feet?

× 33 × 19 = 627 × 23½ = 24630 + by 12 = 1219½ inch-feet. Ans.

34.—In four planks of mahogany, each 25 feet long, 9½ inches broad, and 3 inches thick, how many feet? Ans, 142½ ft.

35.—In six planks, each 18 feet long, 8½ inches broad, and 1¼ inch thick, how many feet and solid feet? Ans. 95 ft. 7½ in., and 8 solid ft.

SPECIFIC GRAVITY.

Specific gravity is the relative weight of any body compared with the weight of another taken as a standard of the same bulk. The standard is water: one cubic foot weighs 1000 ounces avoirdupois, at a temperature of 60 Fahrenheit.

TABLE OF THE GRAVITY OF WOOD, FROM CORK TO LIGNUMVITÆ.

	Specific Gravity.		Specific Gravity.
Cork	246	Maple and Riga Fir	750
Poplar	383	Ash and Dantzic Oak... ...	760
Larch	544	Yew, Dutch...	788
Elm and English Fir	556	Apple Tree	793
Mahogany, Honduras... ...	560	Alder	800
Willow...	585	Yew, Spanish	807
Cedar	596	Mahogany, Spanish	852
Pitch Pine	560	Oak, American	872
Pear Tree	661	Boxwood, French	912
Walnut	671	Logwood	913
Fir, Forest	694	Oak, English	970
Beech	696	Ditto, sixty years' cut... ...	1170
Cherry Tree...	715	Ebony	1331
Teak	745	Lignumvitæ...	1333

PROBLEM 11.

To find the magnitude of any body from its weight.

RULE 10.—Weight of the body in ounces divided by its specific gravity in table = content in cubic feet.

EXAMPLES.

36.—How many cubic feet are there in one ton of mahogany?

1 ton = 20 cwt. = 35840 ounces in a ton.

Look to mahogany, and opposite you will find 560, which, divided into the ounces of a ton will stand thus:—

÷560)35840

64 cubic feet. Ans.

And the timber being fir, look to fir and you will find 556, which, divide into the ounces of a ton, thus:—

÷556)35840 ounces.

64·46 cubic feet, Ans.

Or English Oak:—

÷970)35840

36·94

PROBLEM 12.

To find the weight of a body from its bulk.

Rule 14.—Cubic feet × specific gravity = weight in ounces.

EXAMPLE.

37.—What is the weight of a log of larch, 14 feet long, 2½ broad, and ¼ thick?

ft. ft. ft.
2·5 × 1·25 × 14 = 43·750 : then,
43·750 × 544 = 2380 ounces = 13 cwt. 1 qr. 3 lbs. 8 oz. Ans.

PROBLEM 13.

Sawyers' work.

Measure off your several cuts alternately with a line, which afterwards measure on a rule.

Rule 15.—Multiply the line by length in feet and inches, and you will have the product required.

EXAMPLE.

38.—A it 34 feet, 6 inches line, by 9½ feet long.
ft. in. ft. in.
× 34 · 6 by 9 · 6 = 327 feet 9 inches, Ans.

EXERCISE XXV.

CARPENTERS' WORK.

Roofing and flooring are measured by the square of ten feet each way, one hundred square feet being one square of work.

Rule 1.—Multiply the given dimensions together in feet and inches, which product, divided by one hundred (by cutting off the figures to the right) will give the squares required.

EXAMPLES.

1.—A piece of work, 96 feet 3 inches, by 21 feet 3 inches: required the number of squares contained therein?

ft. in. sq. ft. in.
× feet 96.3 inches, by 21 3 = 2045·3·9 ÷ 100 = 20 45 3¾ Ans.

2.—A piece of work, 14 feet 6 inches, by 10 feet 3 inches: required the square yards contained?

× 14½ by 10¼ = 148⅛ ÷ by 9 = 16$\frac{3}{72}$ yards. Ans.

EXERCISE XXVI.

CALCULATION OF GLAZIERS' WORK.

The dimensions used are feet, inches, and parts; in some instances, feet, tenths, and hundredths. The work is calculated in square feet.

Windows are sometimes measured by taking the dimensions of one pane, and multiplying its superficies by the number of panes. But generally they take the length and breadth of the whole frame for the glazing. Circular windows are measured as if they were square, taking for their dimensions the greatest length and breadth.

1.—In a pane of glass, 3 feet 6 inches and 9 parts long, and 1 foot 3 inches and 3 parts broad, how many feet of glass in that pane?
$\times 3{\cdot}6{\cdot}9$ by $1{\cdot}3{\cdot}3 = 4$ ft. 6 in. 3 pts. 11 sec. 3 thrds. Ans.

2.—How many feet of glass are there in 10 panes, each 4 feet 8 inches and 9 parts long, and 1 foot 4 inches and 3 parts broad? Ans. 60,403 ft.

3.—How many feet of glass are there in 20 panes, each 3 feet 6 inches and 9 parts long, and 1 foot 3 inches and 3 parts broad? Ans. 80 ft. 6 in. 6 pts.

4.—If a window be 7 feet 6 inches high, and 3 feet 4 inches broad, how many square feet of glass are in it? Ans. 25 feet.

5.—How many feet in an elliptical fan-light; 14 feet 6 inches in length, and 4 feet 9 inches in breadth? Ans. 68 ft. 10 in.

6.—What will the glazing of a triangular sky-light come to at 20d. per foot, the base being 12 feet 6 inches, and the height 6 feet 9 inches? Ans. £3 10s. 3¼d.

EXERCISE XXVII.

CALCULATION OF BRICKLAYERS' WORK.

The chief part of this work is measured by the perch, being twenty-one feet long, nine inches thick, and one foot high.

TABLE.

500 bricks, 1 load.	16 cubic feet, 1 ton of Portland stone.
1000 tiles, 1 load.	20 cubic feet, 1 ton of bath stone.
12 cubic feet, 1 ton of marble.	

RULE 1.—Multiply length by height in feet and inches, and that product by the inches in thickness, which last product divide by nine, and that quotient by twenty-one, will give the perches sought standard measure; but when the thickness is nine inches only, multiply the given length and height together, and divide by twenty-one for perches.

EXAMPLE.

1.—A piece of work, 66 feet long, 20 feet 6 inches high, and 28 inches thick, how many perches are contained therein?

ft. ft.
× 66·0 by 20·6 = 1353 × 28 = 37884 ÷ 9 = 4209·3 ÷ by 21 = 200 p. 9 ft. 3 in. Ans.

NOTE.—One thousand of our common bricks (mortar and work) will make four perches and a quarter of work.

Two hundred and thirty-six bricks (mortar and work) will make a perch.

In rough stone work.

Twenty-one feet long, twelve inches high, and eighteen inches thick, make a perch.

Multiply as above, that is, length and height together, in feet and inches, and the product multiply by the inches in thickness, which last product divided by 18, and that quotient by 21, gives the perches; but when the thickness is 18 inches only, multiply the given length and height together, and divide by 21 for perches.

To find the solid content of a marble block.

RULE 2.—Multiply length by breadth in feet and inches, and that product by the depth in feet and inches, which will give you the solid content in feet.

Observe.—Twelve solid feet of marble make a ton.

EXAMPLES.

2.—How many solid feet in a marble block, 6ft. 6 in. long, 2 ft. 4 in. broad, and 1 ft. 3 in. thick?

ft.in. ft.in. ft.in. ft.in.
× 6·6 by 2·4 = 15·2 × 1·3 = 18ft. 11 in. 6 pts. Ans.

3.—What is the content of a marble block 10 feet 6 inches long, 4 feet 6 inches broad, and 1 foot 6 inches thick?

× 10 ft. 6 in. by 4 ft. 6 in. = 47 ft. 3 in. × 1 ft. 6 in. = 70 ft. 11 in. 6 pts. Ans.

4.—What is the content of a block 4 feet 3 inches long, 2 feet 6 inches broad, and 2 feet 1 inch 5 parts thick? Ans. 22 ft. 6 in. 0 pts. 7″.6‴.

SLATERS' WORK

Is measured by the square of one hundred square feet.

GENERAL OBSERVATIONS.—No deduction for chimney shafts. Add valleys, and eves, to the roof as double measurement.

600	Double slates	cover...	1 square.
1000	Single do.	do.	1 square.
165	Tiles ...	do.	1 square.
40	Laths ...	do.	1 square.
1	Ton slates	do.	1¼ square.

5.—How many squares in a roof of double slating, 68 ft. long, and 19½ from the eve to the pitch of the roof?

× 68 by 19½ = 1326 ÷ by 600 = 2¼ nearly.

EXERCISE XXVIII.

TONNAGE OF SHIPS.*

RULE 1.—Multiply the length of the keel, taken within the vessel, by the length of the midship beam, taken within, from plank to plank, and that product by half the breadth, taken as the depth; then divide the last product by 94, and the quotient will be the tonnage.

EXAMPLES.

1.—If the length of a ship's keel be 80 feet, and midship beam 30, give the required tonnage?

× 80 by 80 = 2400 × 15 = 36000 ÷ 94 = 382$\frac{2}{3}\frac{2}{4}$ tonnage.

2.—If the length of a ship's keel be 87 feet 6 inches, and the midship beam 28 feet 8 inches, find the required tonnage? Ans. 382$\frac{4}{3}\frac{2}{4}$.

RULE 2.—Take the dimensions on the outside of the light mark, as the ship floats unladen, to find the content of the empty ship. But if the measure of the ship be taken from the light mark to her full draught of water, when laden, it will give the burden of the ship; then the length, breadth, and depth multiplied together, and the product divided by 100 for men-of-war (which gives an allowance for guns, anchors, &c., that are all burdens, but no tonnage,) and by 95 for merchant ships, will give the tonnage.

Observe.—A hundred solid feet make a ton.

3.—Required the tonnage of Noah's Ark, the length being 300 feet, breadth 50, and depth 30?

× 300 by 50 = 15000 × 30 = 450,000 ÷ by 95 = 4736$\frac{1}{1}\frac{0}{9}$ tonnage. Ans.

RULE 3.—The shipwrights of London multiply the length of the keel by the extreme breadth of the ship, taken from out to outside, and that product by half the breadth; and this they divide by 94 for merchant ships, and 100 for men-of-war; the quotient is the tonnage of the respective classes.

4.—What is the tonnage of an 80-gun ship, the length of whose keel is 149 feet 4 inches, and the extreme breadth 49 feet 8 inches? Ans. 184I$\frac{9}{7}\frac{4}{8}$.

5.—The given length of keel of a 74 is 138 feet, and the extreme breadth 46 feet 9 inches; what is the tonnage? Ans. 1508$\frac{3}{6}\frac{9}{0}\frac{0}{0}$.

* Though the Admiralty have changed their mode of calculating for the tonnage of ships, the above method will be found more simple, brief, as accurate, and less complicated.

A method practised in the Royal Navy.

DIRECTIONS.—Let fall a perpendicular from the foreside of the stern at the height of the hawse hole, and another from the back of the main port at the height of the wing transom; from the distance between these perpendiculars deduct $\frac{3}{5}$ of the extreme breadth, and as many times $2\frac{1}{2}$ inches as there are feet in the height of the wing transom above the upper edge of the keel; the remainder is the length of the keel for tonnage.

RULE 4.—Multiply the length of the keel by the extreme breadth and that product by half the breadth; then divide by 94 for the tonnage.

6.—Given the length of the keel 68 feet, and the extreme breadth 22; required the tonnage? Ans. $175\frac{8}{94}$

7.—What is the tonnage of a ship whose keel is 78 feet, and the extreme breadth $24\frac{1}{2}$? Ans. $249\frac{2}{4}$.

8.—The length of the keel is 70 feet, and the extreme breadth 24; what is the tonnage? Ans. $214\frac{4}{8}\frac{4}{4}$.

FOREIGN WEIGHTS AND MEASURES.

CAPE OF GOOD HOPE.

LIQUID MEASURE.

16 flasks ... ... = 1 anker.
4 ankers ... ... = 1 aam.
4 aams... ... ... = 1 leaguer.

CORN.

4 schepels ... ... = 1 muia.
10 muias ... ... = 1 load.
The muia of wheat weighs 196 lbs. English = 3 imperial bushels.

CLOTH AND LONG MEASURE.

12	Rhyland inches	=	1	Rhyland foot.
27	ditto	„	1	Dutch ell.
144	ditto	„	1	square foot.
164	square feet...	„	1	rood.
600	roods	„	1	morgen.

Accounts in £ s. d., or Rix Dollars, Schillings, or Stivers.

1	stiver	=	$\frac{2}{3}$ of a penny.
6	stivers	„	1 schilling, or $2\frac{1}{2}$d. sterling.
1	rix dollar	„	18d. sterling.

CHINA—CANTON.

Merchandise weights are the pecul, catty, and tael. The pecul is divided in 100 catties, or 1600 taels.

1	tael weighs avoirdupois		$1\frac{1}{3}$ oz.
16	taels, or 1 catty	=	$1\frac{1}{3}$ lbs.
100	catties, or 1 pecul	=	$133\frac{1}{3}$ lbs.

A pecul weighs 162 lbs., 3 dwts., 3 grs., troy. English weights are used in delivering a cargo, and are afterwards changed into catties and peculs.

The weights are the candy of 20 mounds; the mound is divided into 8 vis, 320 pollams, or 3200 pagodaes; this vis is divided into 5 seers. The candy of Madras = 500 lbs. avoirdupois; the pagoda, 2 oz. 3 grs.

The measures of capacity are the garce (or corn measure), containing 80 parahs, or 400 marcals, each marcal 8 puddies, or 64 ollocks. The marcal measures 750 cubic inches, and weighs 27 lbs., 2 oz., 2 drs., of spring water, consequently 45 marcals are equal to 15 Winchester bushels.

Accounts are kept in rupees: 12 fanams = 1 rupee; 80 cash = 1 fanam; and 42 fanams = 1 pagoda. The gold coins are the star, or current pagoda, which = 7s. 5½d.; the gold rupee, value at the English mint = £1 9s. $2\frac{1}{4}\frac{1}{2}$d.

GERMANY—BREMEN.

2 loths	=	1 ounce.
8 ounces	„	1 mark.
2 marks	„	1 commercial lb., or 7690 English qrs.
1 centner	„	116 lbs.

DRY MEASURE.

4 pints	=	1 viertel.
4 viertels	„	1 scheffel.
10 scheffels ...	„	1 quart.
4 quarts	„	1 last.

1 last = 10 qrs. 0.7 bushels; a barrel of salt = 3½ scheffels; a last of coals = 2 chaldrons, Newcastle measure.

1 shippound	=	2½ centners, or 290 lbs.
1 wadge of iron	„	120 lbs.
1 stone of flax	„	20 lbs.
1 ditto wool	„	10 lbs.
1 ton of butter	„	300 lbs.

LIQUID MEASURE.

8 quarts	=	1 viertel.
5 viertels	„	1 anker.
4 ankers	„	1 tierce.
1½ tierce	„	1 oxhoft.
1 oxhoft	„	38 English wine gals.

A barrel of whale oil = 6 stecken, or 216 lbs. = 31½ English wine gals. Accounts are kept in rix dollars of 72 grotes; the grote is divided into 5 swares; a Bremen rix dollars = 3s. 2d. sterling; par of exchange £1 sterling = 6 rix dollars, 32 grotes, 4 swares.

HAMBURGH.

WEIGHTS.

1 centner	=	112 pounds.
1 lb.	“	32 ounces.
1 oz.	“	4 drachms.
1 drachm ...	“	4 pfennings.
1 schiffpund ...	“	2½ centners.

or 20 liespfund of 14 lbs. each, or 280 lbs.

1 pipe of oil = 820 lbs.; a barrel of butter (willow and hoops) 224 lbs.; common hoops 230 lbs. nett.

GRAIN MEASURE.

1 last ...	=	60 fass.
1 fass ...	“	2 himpten.
1 himpten	“	4 spint.
20 fass ...	“	1 wispel of wheat or rye.
30 fass ...	“	1 do. oats or barley.
2 fass ...	“	1 scheffel of wheat.
3 fass ...	“	1 do. of oats or barley.

1 Hamburgh last = 11 imperial quarters.

LIQUID MEASURE.

1 fuder ...	= 6 aums.		
1 aum ...	" 4 ankers, or 5 emers.		
1 anker ...	" 5 viertels.		
1 viertel	" 2 stubchen.		
1 stubchen	" 2 kannen.		
1 kannen	" 2 œssel quartiers.		
1 emier ...	" 4 viertels.		

1½ aums, or 6 ankers, or 30 viertels, each of 8 quartiers, or bottles =1 hogshead.

Accounts are kept in marks of 12 pfennings of two sorts—banco and current; the banco estimated at 1s. 5½d.; the mark current at 1s. 2½d., sterling.

PRUSSIA—DANTZIC.

32 loths	make	1 ounce.	
16 ounces ...	...	1 pound.	
16½ pounds ...	...	1 lispound.	
20 pounds ...	...	1 small stone.	
33 pounds	make	1 large stone.	
110 pounds ...	...	1 centner.	
3 centners ...	...	1 shippound. (330 lbs.)	

LIQUID MEASURE.

5 quarts ...	make ...	1 anker.	
4 ankers ...	... ...	1 ahm.	
1½ ahm ...	... .	1 hhd.	
2 hhds. ...	make ...	1 both.	
2 boths ...	... ...	1 fuder.	
2 fuders ...	... ...	1 last.	

A pipe = 2 ahms; the ahm = 39¾ English gallons.

CORN MEASURE.

The last of 60 scheffells=11 quarters 3 bushels, and the last of 56½ scheffells=10 quarters 7 bushels. Oak planks, deals, and pipe staves are sold per shock of 50 pieces. Wheat, rye, &c., of 56½ scheffells. Accounts are kept in thalers or dollars, silver groschen and pfennings.

1 thaler	= 30 silver groschen.	The thaler is generally estimated at 3s.
1 groschen	= 12 pfennings.	

TUSCANY—LEGHORN.

The pound is divided into 12 ounces, 96 drachms, 288 denai, and 6912 grani, and equal 5240 English grains. The quinta or centinajio=150 lbs.; the centaro=150 lbs., but a centaro of sugar=151 lbs., oil 88 lbs., brandy 120 lbs., stock fish 160 lbs. The rotolo=3 lbs. Corn is sold by the sack or sacco, 4 of which are equal to one imperial quarter.

LIQUID MEASURE.

2 mezette=1 boccale; 2 boccali=1 fiasco; 20 flaschi=1 barile or 12 English wine gallons; the barile of oil is about 66 lbs. avoirdupois, or 16 fiaschi of 2 boccali each.

Long measure is bracico, divided into 20 solidi, 60 quattrine or 24 denaii. 155 bracci=100 English yards. 1 canna of 4 bracci=12 English inches.

Accounts are kept in lire Toscane: the lire is divided 20 solidi di lire, each of 5 centicimi.

NAPLES.

The weights are the cantaro and rotola. The cantaro gross=196½ lbs. avoirdupois; the cantaro piccolo 106 lbs. avoirdupois. In corn, 36 tomolo=$1\frac{2}{10}$ Winchester bushel.

In wine the carro is 2 botti, 24 barrile or 1440 carraffe. 1 carro=264 English wine gallons. A pipe of wine or brandy is 132 English gallons. *Oil*:—The salma is divided into 16 staje; 256 quarti, or 1536 misurette; 1 salma=42¾ English wine gallons. *Long Measure*:—The canna is divided into 8 palmi, or 96 onzie, and=6 feet 11 inches English. Accounts are kept in ducati di regno of 100 grani. 1 ducat=10 carlina, or 3s. 5½d. nearly, sterling. The oncetta=10s. 3½d., the smallest gold piece.

PORTUGAL — LISBON.

WEIGHTS.

8 ounces make a marc, 2 marcs a pound or arratel, 22 pounds 1 arroba, 4 arrobas 1 quintal. For corn and salt the measure is the moyo, divided into 15 fanegas, 30 alquirés, 240 quartos, &c. *Liquids*:—The almude is divided into 2 potes, 12 canadas, or 48 quartelles. 18 almudes=1 baril; 26 almudes=1 pipe; and 52 almudes=1 tonelado, which last 227½ English wine gallons. A Lisbon pipe of 31 almudes is equal to 140 English gallons.

LENGTH.

3 palmos make a covado or cubit; 1⅔ covados=1 vara; 2 varas=1 branco. Accounts are kept in rees, 1000 of which make 1 milrae. The gold piece of 6400 rees=35s. 11d. sterling and the gold cruisado=2s. 3d.

RUSSIA — PETERSBURGH.

Gold, Silver, or Merchandise:—3 sotnicks make 1 loth; 32 loths, 1 pound; 40 pounds, 1 pood; 10 poods, 1 berkovitz. The pood=36 lbs. 10 oz. 11 drs. avoirdupois. *Long Measure*:—16 wershok make 1 arsheen; 8 arsheen=1 sashen; 50 sashen=1 verst; 1 sashen=7 English feet; 1 arsheen=28 English inches; 100 Russian feet=114½ English feet; 1 verst=5 furlongs 12 poles.

The chief measure in corn is the chetwert, subdivided into 2 osmins, 4 pajocks, 8 chetwericks, or 64 garnitz.

Accounts are kept in roubles of 100 copecks. The gold and silver coins are, the imperial or 10 rouble pieces=£1 12s.; half imperial=16s.; silver rouble=3s. 2¾d.

SPAIN—CADIZ.

As there are such discrepancies in weights and measures in the different provinces, we shall give those of Castile.

The quintal is divided into 4 arrobas, or 100 lbs. of 2 marcs each; 100 Castile lbs.=101½ avoirdupois lbs; 100 baras or yards=12¾ English yards. In corn measure, there is the cahiz, divided into 12 panegas, or 144 celeminas, or 576 quartillas. 5 panegas=1 English quarter.

LIQUID MEASURE.

The cantaro or arroba is divided into 2 azumbres and 32 quartillas. There are two sorts of arrobas, the greater and lesser: the former=4¼ English wine gallons, the latter 3¼ ditto.

1 mazo makes 16 arrobas; 1 botta=30 arrobas wine, or 39½ oil; 1 pipe= 27 arrobas wine, or 34½ oil; 1 botta=127½ English gallons, and 1 pipe= 114¾ ditto.

Accounts are kept by the real, of which there are 10⅔ in the peso duro, or hard dollar. A real is divided into 16 quintos or 34 maravedis: a dollar =4s. 4¼d. sterling; a real 4¼d.

FOREIGN EXCHANGES BY THE CHAIN RULE.

The chain rule, or rule of equations, is used in calculating exchanges, and saves the continued statings required by the Double Rule of Three.

RULE.—Reduce all the quantities of the same kind to the same name. Change all numbers of *unequal* kinds into fractions. Let x express the required quantity, and to the right of it place, as consequent, the term to which it is equivalent; then, below x, as *antecedent*, the other given term which is of the same kind as the last *consequent*, and to the right of it, the term which is equivalent to it; next, multiply the consequents or right hand terms together for a product, and divide it by the product of the multiplication of the antecedents or left hand terms, and the quotient will be the result.

EXAMPLE.

1.—What will an estate, worth £39,420 per annum, amount to in a minute?

x	1 minute.
Minutes, 60	1 hour.
Hours, 24	1 day.
Days, 365	1 year.
Year, 1	£39,420.
£1	20s.
1s.	12d.

$365 \times 24 \times 60 = 525600 \div £39420 =$ 1s. 6d. per minute.

AMSTERDAM.

16 pennings = 1 stiver; 20 stivers = 1 guilder or florin; 2½ florins = 1 rix dollar; 6 florins = 1 pound (Flemish) 100 cents = 1 florin.

EXAMPLE.

2.—What is the exchange of £500 sterling in florins and stivers, at 12 florins 3 stivers, per pound sterling?

x	£500
£1	12 florins 3 stivers.

$500 \times 12{\cdot}3 = 6075$ florins.

HAMBURGH.

12 pfennings = 1 schilling; 12 schilling = 1 mark; 2 marks = 1 dollar; 3 marks = 1 rix dollar.

NOTE.—There are two kinds of money at Hamburgh, banco and currency: banco is the same as Flemish.

6 pfennings = 1 groat or penny; 12 pence = 1 schilling; 20 schillings = 1 pound.

EXAMPLE.

3.—Exchange £620 10s. sterling into marks, banco at 13 m. 8 sc. per £.?

x £620½
2 = 1 ... ... 13 m. 8 sc.

1241 × 13·8 ÷ 2 = 8376 marks, 12 sch.

PARIS.

10 mils=1 centime; 10 centimes=1 décime; 10 décimes=1 franc.

EXAMPLES.

4.—Exchange £700 into francs and cents, at 25 f. 20 c. per £. sterling?

x £700
£1 ... ... 25 francs 20 cents.

700 × 25·20 = 17640 francs.

A new Plan of bringing French Coins to British Money, and British to French.

RULE.—Cut off two figures to the right in the francs, and multiply the figures to the left by 4, and the product will be pounds sterling; 25 francs make a pound, and 10d. a franc, so the figures to the right will count so much of a pound. Bring the British to French by dividing by 4, adding 2 ciphers to the quotient for francs.

EXAMPLES.

5.—In 2500 francs, how many pounds?

25,00
4

Ans. £100

6.—In 240 pounds, how many francs?

£
÷4) 240

Ans. 6000 francs.

FRANKFORT.

4 hellers=1 kreuzer; 4 kreuzers=1 batz: 15 batzen or 60 kreuzers= 1 florin; 90 kreuzers or 1½ florins=1 rix dollar.

EXAMPLE.

7.—Exchange £600 10s. sterling into florins and kreuzers, at 120¼ fl. per £10 sterling.

x ... ... £600½=1201.
1200 k.=10 ... ... 120¼ fl.=7245 k.

1201 × 7245 ÷ 1200=7251 florins.

VIENNA.

60 kreuzers=1 florin; 90 kreuzers=1 rix dollar.

EXAMPLE.

8.—Exchange £850 sterling into florins and kreuzers, at 10 florins 2 kreuzers per £.?

x ... ... £850.
£1 ... ... 10 fl. 2 k.

850 × 602 k. = 8528 fl. 20 k.

GENOA.

100 centisima=1 lira nuova.

EXAMPLES.

9.—Exchange £620 10s. sterling into lira nuova and centis, at 25 l. 35 c. per £.?

x £620½
£1 ... ... 25 l. 35 c.

620½ × 25·35 = 15729 l. 67 c.

BERLIN.

30 silver groshen=1 Prussian dollar.

EXAMPLE.

10.—Exchange £400 sterling into Prussian dollars, at 6 dol. 26 s. g. per £?

x ... ... £400.
£1 ... ... 6 dol. 26 s. g.

400 × 6·26 = P. dol.. 2746, 20 s. g.

MILAN.

4 denari=1 soldo; 20 soldi Austriachi=1 lira Austriacha; 100 centisimi=1 lira Austriacha.

EXAMPLE.

11.—Exchangs £340 10s. sterling into lira Austriacha, at 29 l. 50 c. per £?

x ... ... £340½.
2=£1 ... ... 29 l. 50 c.

681 × 29·50 ÷ 2 = 10044 l. 75 c.

LEGHORN.

5 centisimi=1 soldo di lira; 20 soldo di lira=1 lira Toscana; 100 centsimi=1 ditto.

EXAMPLE.

12.—Exchange £675 12s. 6d. sterling into lira and centisima, at 30 l. 69 c. per £?

x ... ... £675½=5405.
8=£1 ... ... 30 l. 69 c.

5405 × 30·69 ÷ 8 = 20734 l. 93 c.

LISBON.

400 rees=1 crusado: 1000 rees=1 milree; 1000 milrees=1 conto of rees; 4800 rees=1 moidore; 2½ crusadoes=1 milree.

EXAMPLE.

13.—Exchange £420 10s. sterling into contos of rees, milrees and rees, at 56½d. per milree?

x ... ... £420½=841.
£1 ... ... 240d.
113=56½d. ... ... 1000 rees.

841 × 240 × 1000 ÷ 113 = 1 r. 786 m. 460 r.

MADRID.

2½ maravedis=1 quarto; 34 maravedis or 16 quartos=1 real; 8 reals=1 piastre or dollar of plate; 4 piastres or 32 reals=1 pistole of plate or exchange; 375 maravedis=1 ducat of plate or exchange 17 reals of plate=32 reals of vellon; 85 dollars of plate=64 hard dollars; 1 quarto=4 maravedis vellon.

EXAMPLE.

14.—Exchange £400 sterling into reals of plate, at 36d. piastre of plate?

x ... ... £400.
£1 ... ... 240d.
36d. ... ... 8 reals.

400 × 240 × 8 ÷ 36 = 21333⅓ reals of plate.

GIBRALTAR.

16 quartos=1 real; 12 reals=1 dollar.

EXAMPLE.

15.—Exchange £750 12s. 6d. sterling into Spanish hard dollar, at 51d. per dollar?

x	... ...	750½=6005.
£1	... ...	240d.
408=51	... ...	1 hard dollar.

6005 × 240 ÷ 408 = 3532 h. d., 4 r., 16 qr.

NAPLES.

10 grani=1 carlino; 20 grani=1 taro; 5 tari or 10 carlini=1 ducat; 100 grani=1 ducat.

EXAMPLE.

16.—Exchange £300 sterling into Neapolitan ducats, at 40d. per ducat?

x	... ...	£300
£1	... ...	240d.
40d	... ...	1 ducat.

300 × 240 ÷ 40 = 1800 ducats.

PALERMO.

20 grani=1 taro; 12 tari=1 scudo; 30 tari=1 onza; 2 onzie=5 scudi.

EXAMPLE.

17.—Exchange £420 10s. sterling into onzie, at 120d. per onza?

x	... ...	£420½=841
£1	... ...	240d.
240=120	... ...	1 onza.

841 × 240 + 240 = 841 onzie.

VENICE.

4 denari=1 soldo; 20 soldi Austriache=1 lira Austriachi; 100 centisimi=1 lira Austriachi.

EXAMPLE.

18.—Exchange £860 sterling into lira Austriache, at 48d. per lira Austriachi?

x	... ...	£860
£1	... ...	240d.
48d.	... ...	61. Aus.

860 × 240 × 6 ÷ 48 = 25800 l. Aus.

ST. PETERSBURGH.

One hundred copecks = one ruble.

EXAMPLE.

19.—Exchange £500 sterling into silver rubles, at 37d. per silver ruble?

x	£500
£1	240d.
37d.	1 s. ruble.

$500 \times 240 \div 37 = 3243$ s. r., 24 copecks.

NEW YORK.*

10 dollars = 1 eagle; 10 dimes = 1 dollar; 10 cents = 1 dime; 10 mils = 1 cent.

EXAMPLE.

20.—Exchange £500 into dollars and cents, at a premium of 10 per cent?

x	£500
£9	40 dollars.
100 dollars	110 dols. with prem.

$500 \times 40 \times 110 \div 9 \times 100 = 2444$ dols. 44 cents.

* In the United States, the dollar is usually valued at 4s. 6d., allowing 40 dollars for £9 sterling, or 444 dollars, 44 cents for £100. But by an act of Congress lately passed, the custom-house values the £ sterling at 4 dollars 8 cents, which is 4s. 2d. per dollar, and is equal to a premium of 8 per cent on the fixed premium of 4s. 6d. per dollar. The value of the half-eagle is 22s. 6d.

EVERY SPIRIT MERCHANT HIS OWN GAUGER.

THE following table will show, at one view, the quantity of liquor in casks or puncheons, to the tenth of a gallon, from 10 to 130 gallons, which can be ascertained by dipping with a common inch rule into either keg or puncheon, when lying on the side or standing on the end.

Observe.—If the cask be lying on the side, dip the rule into the bung-hole; count the wet inches; look to the table for the number required, and opposite, in the next column, you will find the number of gallons and tenths. The third column shows the content if the cask be standing.

TEN GALLONS.

12-*inch Bung*

Inch	G. 10ths	Altitude
1 is	0·4 is	0·7
2	0·9	1·4
3	1·6	2·2
4	2·6	2·9
5	3·5	3·6
6	5·0	4·4
7	5·5	5·0
8	6·4	5·8
9	7·4	6·6
10	8·3	7·3
11	9·6	8·0
12	10·0	8·8

TWENTY GALLONS.

17-*inch Bung.*

Inch	G. 10ths	Altitude
1 is	0·3 is	0·7
2	1·2	1·3
3	2·0	2·5
4	3·2	3·6
5	4·5	4·5
6	6·0	5·5
7	7·5	6·6
8	9·1	7·6
9	10·6	8·7
10	12·3	10·0
11	14·0	11·1
12	15·5	12·2

THIRTY-THREE GALLONS.

21-*inch Bung.*

Inch	G. 10ths	Altitude
1 is	0·6 is	1·0
2	1·7	2·0
3	3·1	3·1
4	4·3	4·3
5	6·0	5·5
6	7·9	6·7
7	9·4	8·0
8	11·5	9·4
9	13·5	11·0
10	15·6	12·5
11	17·3	14·0
12	19·5	15·6

FIFTEEN GALLONS.

14-*inch Bung,*

Inch	G. 10ths	Altitude
1 is	0·4 is	0·7
2	1·2	1·3
3	2·0	2·1
4	3·2	3·0
5	4·5	3·7
6	6·0	4·6
7	7·5	5·5
8	9·0	6·4
9	10·0	7·5
10	11·8	8·4
11	12·9	9·3
12	13·8	10·2

TWENTY-ONE GALLONS.

18-*inch Bung.*

Inch	G. 10ths	Altitude
1 is	0·5 is	0·7
2	1·9	1·2
3	2·7	2·0
4	3·9	3·0
5	4·6	4·0
6	6·0	5·1
7	7·0	6·2
8	8·8	7·3
9	10·5	8·4
10	12·0	9·5
11	13·4	10·5
12	14·6	11·5

THIRTY-SIX GALLONS.

22-*inch Bung.*

Inch	G. 10ths	Altitude
1 is	0·6 is	1·1
2	1·6	2·3
3	3·0	3·5
4	4·4	4·7
5	6·2	6·1
6	7·8	7·5
7	9·9	8·9
8	11·6	10·4
9	13·8	11·9
10	15·7	13·5
11	18·0	15·2
12	20·3	17·0

FORTY-TWO GALLONS.

24-inch Bung.

Inch	G. 10ths	Altitude
1 is	0·5 is	1·2
2	1·5	2·4
3	3·2	3·8
4	4·7	5·2
5	6·4	6·7
6	8·2	8·2
7	10·1	9·8
8	12·0	11·5
9	14·1	13·2
10	16·5	15·1
11	18·8	17·0
12	21·0	19·0

FORTY-FOUR GALLONS.

24-inch Bung.

Inch	G. 10ths	Altitude
1 is	0·5 is	1·1
2	1·9	2·3
3	3·3	3·6
4	4·9	5·0
5	6·7	6·5
6	8·6	8·1
7	10·5	9·8
8	12·6	11·5
9	14·8	13·5
10	16·9	15·4
11	19·2	17·5
12	22·0	19·6

FIFTY-FOUR GALLONS.

26-inch Bung.

Inch	G. 10ths	Altitude
1 is	0·8 is	1·3
2	1·9	2·7
3	3·0	4·3
4	4·6	5·7
5	6·3	7·4
6	8·2	9·8
7	10·4	11·0
8	13·0	12·6
9	15·5	14·5
10	18·3	16·4
11	21·2	18·3
12	24·1	20·7

SIXTY GALLONS.

26-inch Bung.

Inch	G. 10ths	Altitude
1 is	0·8 is	1·4
2	2·2	3·0
3	4·0	4·5
4	5·6	6·2
5	7·9	7·9
6	10·4	9·7
7	13·1	11·5
8	15·8	13·4
9	18·7	15·4
10	20·9	17·4
11	23·9	19·5
12	26·9	21·7

SIXTY-THREE GALLONS.

26-inch Bung.

Inch	G. 10ths	Altitude
1 is	0·8 is	1·5
2	2·3	3·1
3	4·2	4·8
4	5·9	6·6
5	8·3	8·4
6	10·9	10·2
7	13·7	12·2
8	16·6	14·2
9	19·6	16·2
10	21·9	18·4
11	25·1	20·6
12	28·2	22·9

SIXTY-FIVE GALLONS.

27-inch Bung.

Inch	G. 10ths	Altitude
1 is	0.8 is	1·5
2	2·0	3·1
3	3·8	4·8
4	6·1	6·6
5	8·6	8·5
6	10·6	10·3
7	13·4	12·3
8	16·3	14·3
9	18·7	16·5
10	21·8	18·7
11	24·6	21·0
12	27·6	23·5

SIXTY-SIX GALLONS.

27-inch Bung.

Inch	G. 10ths	Altitude
1 is	0·8 is	1·6
2	2·0	3·3
3	3·9	5·1
4	6·2	6·9
5	8·7	8·8
6	10·7	10·8
7	13·6	12·9
8	16·0	15·0
9	19·0	17·1
10	22·0	19·4
11	25·0	21·7
12	28·0	24·1

SIXTY-EIGHT GALLONS.

27-inch Bung.

Inch	G. 10ths	Altitude
1 is	0·9 is	1·7
2	2·0	3·4
3	4·0	5·3
4	6·3	7·2
5	8·6	9·2
6	11·0	11·2
7	14·0	13·3
8	17·1	15·5
9	19·5	17·7
10	22·8	20·1
11	26·2	22·4
12	28·8	24·9

SEVENTY GALLONS.

27-inch Bung.

Inch	G. 10ths	Altitude
1 is	0·9 is	1·6
2	2·1	3·4
3	4·1	5·2
4	6·5	7·1
5	9·2	9·0
6	11·4	11·0
7	14·4	13·1
8	17·6	15·2
9	20·1	17·4
10	23·3	19·7
11	26·6	22·1
12	29·2	24·5

SEVENTY-FOUR GALLONS.

27-inch Bung.

Inch	G. 10ths	Altitude
1 is	1·0 is	2·1
2	2·6	4·8
3	4·5	7·2
4	7·0	9·9
5	9·9	12·3
6	12·4	14·5
7	15·5	17·0
8	18·6	19·3
9	21·6	22·7
10	25·2	24·6
11	29·0	26·4
12	32·4	29·0

EIGHTY GALLONS.

27-inch Bung.

Inch	G. 10ths	Altitude
1 is	1·0 is	2·0
2	3·0	4·0
3	5·0	7·0
4	7·0	9·0
5	10·0	11·0
6	13·0	13·0
7	16·6	16·0
8	20·1	18·0
9	23·6	20·0
10	27·0	22·0
11	30·8	24·0
12	34·0	27·6

ONE HUNDRED GALLONS.

30-inch Bung.

Inch	G. 10ths	Altitude
1 is	1·8 is	3·2
2	3·0	6·5
3	5·2	9·7
4	7·6	12·9
5	10·4	16·2
6	14·4	19·4
7	17·2	22·7
8	21·9	25·9
9	25·4	29·2
10	28·7	32·4
11	32·9	35·7
12	37·3	38·9

ONE HUNDRED AND TEN GALLONS.

32-inch Bung.

Inch	G. 10ths	Altitude
1 is	1·8 is	2·7
2	3·4	5·4
3	5·4	8·1
4	7·7	11·6
5	10·6	14·2
6	14·6	17·4
7	18·8	21·0
8	22·7	24·2
9	26·6	27·6
10	30·6	31·0
11	34·0	34·5
12	38·0	38·4

ONE HUNDRED AND FIFTEEN GALLONS.

32-inch Bung.

Inch	G. 10ths	Altitude
1 is	1·8 is	2·8
2	3·4	5·9
3	5·4	9·0
4	8·0	12·0
5	11·6	15·6
6	14·9	19·8
7	18·6	23·9
8	22·0	27·9
9	25·6	30·6
10	29·0	34·0
11	33·6	37·9
12	38·6	40·9

ONE HUNDRED AND TWENTY GALLONS.

32-inch Bung.

Inch	G. 10ths	Altitude
1 is	1·6 is	2·6
2	3·4	5·4
3	5·4	8·2
4	7·6	11·4
5	10·0	14·4
6	13·6	18·0
7	16·7	21·5
8	20·9	24·0
9	25·0	27·5
10	29·5	31·0
11	34·5	34·5
12	39·9	38·5

ONE HUNDRED AND TWENTY-THREE GALLONS.

32-inch Bung.

Inch	G. 10ths	Altitude
1 is	1·7 is	2·5
2	3·4	5·2
3	5·6	8·0
4	8·3	10·9
5	12·0	13·8
6	16·0	16·8
7	20·0	20·0
8	24·0	23·2
9	28·1	26·5
10	32·4	30·1
11	36·2	33·6
12	40·3	27·1

ONE HUNDRED AND TWENTY-FIVE GALLONS.

32-inch Bung

Inch	G. 10ths	Altitude
1 is	1·7 is	3·6
2	3·4	7·2
3	5·6	10·4
4	8·5	14·6
5	12·0	17·7
6	16·0	20·5
7	20·0	24·0
8	24·0	27·8
9	28·0	30·2
10	32·6	34·0
11	37·0	38·0
12	42·0	41·6

ONE HUNDRED AND THIRTY-GALLONS.

32-inch Bung.

Inch	G. 10ths	Altitude
1 is	1·8 is	2·6
2	3·6	5·4
3	5·7	8·4
4	8·0	11·4
5	11·6	14·5
6	15·3	17·7
7	19·0	21·2
8	23·0	24·5
9	28·2	28·0
10	33·5	31·4
11	37·5	35·0
12	42·5	38·5

The following Table, calculated for the TEN HOURS' BILL, *shows at one view, the amount per Hour, per Quarter Day, per Half Day, per Three-quarter Day, per Day, per Week, per Month, per Three Months, per Half Year, per Year, from Two Shillings to One Pound per Week.*

Week.	Hour.	Quarter Day.	Half Day.	Three Qr. Day.	Day.	Week.	Month.	Three Months	Half Year.	Year.	Total.
s. d.	d.	d.	d.	d.	d.	s. d.	s.	s.	s.	s.	£. s.
2 0	¼	1	2	3	4	2 0	8	24	48	96	4 16
2 3	¼	1	2¼	3¼	4½	2 3	9	27	54	108	5 8
2 6	⅓	1½	2½	3½	5	2 6	10	30	60	120	6 0
2 9	⅓	1½	2¾	4	5½	2 9	11	33	66	132	6 12
3 0	⅓	1½	3	4¼	6	3 0	12	36	72	144	7 4
3 3	⅜	1½	3¼	4½	6½	3 3	13	39	78	166	7 16
3 6	⅜	1¾	3½	5¼	7	3 6	14	42	84	168	8 8
3 9	⅜	1¾	3¾	5¾	7½	3 9	15	45	90	180	9 0
4 0	½	2	4	6	8	4 0	16	48	96	192	9 12
4 3	1	2	4¼	6¼	8½	4 3	17	51	102	204	10 4
4 6	1	2¼	4½	6¾	9	4 6	18	54	108	216	10 16
4 9	1	2¼	4¾	7	9½	4 9	19	57	114	228	11 8
5 0	1	2½	5	7½	10	5 0	20	60	120	240	12 0
5 3	1	2½	5¼	7¾	10½	5 3	21	63	126	252	12 12
5 6	1	2¾	5½	8¼	11	5 6	22	66	132	264	13 4
5 9	1	2¾	5¾	8½	11½	5 9	23	69	138	276	13 16
6 0	1	3	6	9	12	6 0	24	72	144	288	14 8
6 3	1½	3	6¼	9¼	12½	6 3	25	75	150	300	15 0
6 6	1½	3¼	6½	9¾	13	6 6	26	78	156	312	15 12
6 9	1½	3¼	6¾	10¼	13½	6 9	27	81	162	324	16 4
7 0	1½	3½	7	10½	14	7 0	28	84	168	336	16 16
7 3	1½	3½	7¼	10¾	14½	7 3	29	87	174	348	17 8
7 6	1⅝	3¾	7½	11¼	15	7 6	30	90	180	360	18 0
7 9	1⅝	3¾	7¾	11¾	15½	7 9	31	93	186	372	18 12
8 0	1¾	4	8	12	16	8 0	32	96	192	384	19 4
8 3	1¾	4	8¼	12¼	16½	8 3	33	99	198	396	19 16
8 6	1¾	4¼	8½	12¾	17	8 6	34	102	204	408	20 8
8 9	1¾	4¼	8¾	13¼	17½	8 9	35	105	210	420	21 0
9 0	1¾	4½	9	13½	18	9 0	36	108	216	432	21 12
9 3	1¾	4½	9¼	14	18½	9 3	37	111	222	444	22 4
9 6	1¾	4¾	9½	14¼	19	9 6	38	114	228	456	22 16
9 9	1¾	4¾	9¾	14¾	19½	9 9	39	117	234	468	23 8
10 0	2	5	10	15	20	10 0	40	120	240	480	24 0
10 6	2	5¼	10⅛	15⅜	21	10 6	42	126	252	504	25 4
11 0	2¼	5½	11	16½	22	11 0	44	132	264	528	26 8
11 6	2¼	5¾	11⅛	17¼	23	11 6	46	138	276	552	27 12
12 0	2½	6	12	18	24	12 0	48	144	288	576	28 16
12 6	2½	6¼	12⅛	18⅜	25	12 6	50	150	300	600	30 0
13 0	2½	6½	13	19½	26	13 0	52	156	312	624	31 4
13 6	2⅝	6¾	13⅛	20¼	27	13 6	54	162	324	648	32 8
14 0	2¾	7	14	21	28	14 0	56	168	336	672	33 12
14 6	2¾	7¼	14⅛	21¾	29	14 6	58	174	348	696	34 16
15 0	3	7½	15	22½	30	15 0	60	180	360	720	36 0
15 6	3	7¾	15⅛	23¼	31	15 6	62	186	372	744	37 4
16 0	3	8	16	24	32	16 0	64	192	384	768	38 8
16 6	3¼	8¼	16¼	24¾	33	16 6	66	198	396	792	39 12
17 0	3¼	8½	17	25½	34	17 0	68	204	408	816	40 16
17 6	3⅜	8¾	17⅛	26¼	35	17 6	70	210	420	840	42 0
18 0	3½	9	18	27	36	18 0	72	216	432	864	43 4
18 6	3¾	9¼	18½	27¾	37	18 6	74	222	444	888	44 8
19 0	3¾	9½	19	28½	38	19 0	76	228	456	912	45 12
19 6	3¾	9¾	19½	29¼	39	19 6	78	234	468	936	46 16
20 0	4	10	20	30	40	20 0	80	240	480	960	48 0

The following Table, calculated for ELEVEN HOURS *per diem, shows at one view, the amount per Hour, per Quarter Day, per Half Day, per Three-quarter Day, per Day, per Week, per Month, per Three Months, per Half Year, per Year, from Two Shillings to One Pound per Week.*

Week.	Hour.	Quarter Day.	Half Day.	Three Qr. Day.	Day.	Week.	Month.	Three Months	Half Year	Year.	Total.
s. d.	d.	d.	d.	d.	d.	s. d.	s.	s.	s.	s.	£. s.
2 0	¼	1	2	3	4	2 0	8	24	48	96	4 16
2 3	¼	1	2¼	3¼	4½	2 3	9	27	54	108	5 8
2 6	¼	1¼	2½	3¾	5	2 6	10	30	60	120	6 0
2 9	¼	1½	2¾	4¼	5½	2 9	11	33	66	132	6 12
3 0	¼	1¾	3	4½	6	3 0	12	36	72	144	7 4
3 3	¼	1¾	3¼	5	6½	3 3	13	39	78	156	7 16
3 6	½	1¾	3½	5¼	7	3 6	14	42	84	168	8 8
3 9	½	1¾	3¾	5¾	7½	3 9	15	45	90	180	9 0
4 0	½	2	4	6	8	4 0	16	48	96	192	9 12
4 3	½	2¼	4¼	6¼	8½	4 3	17	51	102	204	10 4
4 6	½	2¼	4½	6¾	9	4 6	18	54	108	216	10 16
4 9	½	2¼	4¾	7¼	9½	4 9	19	57	114	228	11 8
5 3	¾	2¼	5	7½	10	5 0	20	60	120	240	12 0
5 6	¾	2⅜	5¼	7¾	10½	5 3	21	63	126	252	12 12
5 7	1	2½	5½	8¼	11	5 6	22	66	132	264	13 4
5 9	1	2½	5¾	8¾	11½	5 9	23	69	138	276	13 16
6 0	1	3	6	9	12	6 0	24	72	144	288	14 8
6 3	1	3	6¼	9¼	12½	6 3	25	75	150	300	15 0
6 6	1	3¼	6½	9¾	13	6 6	26	78	156	312	15 12
6 9	1¼	3¼	6¾	10¼	13½	6 9	27	81	162	324	16 4
7 0	1¼	3½	7	10½	14	7 0	28	84	168	336	16 16
7 3	1¼	3⅝	7¼	10⅞	14½	7 3	29	87	174	348	17 8
7 6	1¼	3¾	7½	11¼	15	7 6	30	90	180	360	18 0
7 9	1¼	3¾	7¾	11½	15½	7 9	31	93	186	372	18 12
8 0	1½	4	8	12	16	8 0	32	96	192	384	19 4
8 3	1½	4	8¼	12⅛	16½	8 3	33	99	198	396	19 16
8 6	1½	4¼	8½	12¾	17	8 6	34	102	204	408	20 8
8 9	1½	4¼	8¾	13¼	17½	8 9	35	105	210	420	21 0
9 0	1⅝	4⅜	9	13½	18	9 0	36	108	216	432	21 12
9 3	1⅝	4⅜	9¼	14	18½	9 3	37	111	222	444	22 4
9 6	1¾	4½	9¼	14¼	19	9 6	38	114	228	456	22 16
9 9	1¾	4½	9½	14½	19½	9 9	39	117	234	468	23 8
10 0	1¾	5	10	15	20	10 0	40	120	240	480	24 0
10 6	1¾	5¼	10¼	15¾	21	10 6	42	126	252	504	25 4
11 0	2	5½	11	16½	22	11 0	44	132	264	528	26 8
11 6	2	5¾	11½	17¼	23	11 6	46	138	276	552	27 12
12 0	2	6	12	18	24	12 0	48	144	288	576	28 16
12 6	2¼	6¼	12½	18¾	25	12 6	50	150	300	600	30 0
13 0	2¼	6½	13	19½	26	13 0	52	156	312	624	31 4
13 6	2¼	6¾	13½	20¼	27	13 6	54	162	324	648	32 8
14 0	2½	7	14	21	28	14 0	56	168	336	672	33 12
14 6	2⅝	7¼	14½	21¾	29	14 6	58	174	348	696	34 16
15 0	2¾	7½	15	22½	30	15 0	60	180	360	720	36 0
15 6	2¾	7¾	15½	23¼	31	15 6	62	186	372	744	37 4
16 0	2¾	8	16	24	32	16 0	64	192	384	768	38 6
16 6	3	8¼	16½	24¾	33	16 6	66	198	396	792	39 12
17 0	3	8½	17	25½	34	17 0	68	204	408	816	40 16
17 6	3	8¾	17½	26¼	35	17 6	70	210	420	840	42 0
18 0	3¼	9	18	27	36	18 0	72	216	432	864	43 4
18 6	3¼	9¼	18½	27¾	37	18 6	74	222	444	888	44 8
19 0	3½	9½	19	28½	38	19 0	76	228	456	912	45 12
19 6	3½	9¾	19½	29¼	39	19 6	78	234	468	936	46 16
20 0	3⅝	10	20	30	40	20 0	80	240	480	960	48 0

There are 311 working days in a year, omitting Christmas Day and Good Friday.

APPENDIX.

DECIMAL CALCULATIONS.

As the introduction of a decimal currency into this country has been very properly considered by the Legislature, and great pains taken to collect information with regard to a change in our monetary system, and the evidence adduced before a committee of the House of Commons preponderating in favour of a decimal system,—all proving the advantages to be derived from it,—we cannot do better than give, by way of Appendix to the present edition of our book, what we consider sufficient to lay the groundwork of decimal calculations. We, therefore, subjoin such examples in the four fundamental rules of Decimal Arithmetic as will suffice; together with examples for assimilating the present coins with that of the proposed currency, and again converting them into the present money. The first and most essential point for the student, is, to make himself well acquainted with the multiplication table: to assist him in the attainment of this object, we refer him to our new multiplication and division tables, (page 31,) constructed on a plan not given by any other author, and which may be committed to memory with the same facility, and, at the same time, as if learning multiplication only.

In all cases we like to begin at the beginning, and so important a subject requires that the public should be first instructed how to reduce shillings, pence, and farthings into florins, cents, and mils, which are the most likely denominations to be given to the new coins,—reducing the same again into pounds, shillings, and pence; a perfect knowledge of which, will at once show the relative value in both currencies, and should be the first inroad to the public mind.

Our next step will be to calculate quantities at given prices in both currencies, and to show the brevity of the one with the tedious process in the other. In adverting to the proposed change, we may add, that the decimal system will not only prove advantageous to the merchant, the accountant, and the mechanic, but to the rising generation, as well as to teachers and parents. Boys will be taught calculations in the tenth part of the time usually devoted to that purpose; masters will be relieved from the never-ending drudgery of their arduous duties, and parents will save immensely by the early and quick education of their children. By this simple process the student will find calculations an amusement, rather than an embarrassment: and the sooner the system is adopted, the more speedily will he experience its beneficial effects.

It would be well if the merchants and traders of this great commercial country would, together with the professors and teachers, petition Parliament for a speedy completion of the work so wisely contemplated by the Government, and so strongly recommended in the evidences of gentlemen whose opinions we here record from the analysis on the subject before a committee of the House of Commons. We refer:—

Firstly—To that of PROFESSOR AIRY, *Astronomer Royal*, who says: "The present monetary system of this country is in the main very inconvenient, and gives rise, from its irregularity, to much labour and to great liability to error; and that the decimal system would be made in about half the time they now occupy."

Secondly—THOMAS BAZLEY, Esq., President of the Manchester Chamber of Commerce, says: "The simplicity of a decimal coinage would save considerable time and labour in calculations, and might be adopted without inconvenience to the working classes."

Thirdly—DR. JOHN BOWRING, Consul at Canton, and Plenipotentiary at Hong Kong, states: "That in China, children of seven years of age keep accounts with simplicity and facility, and that the system should be introduced quickly; that its adoption is demanded by the benefits that would arise in the keeping of accounts and foreign exchanges."

Fourthly—AUGUSTUS DE MORGAN, Professor of Mathematics in the University, adds: "That the advantages of a change from our present system of coinage to a decimal system, would be

very considerable, and great saving would be effected in calculations generally, and in the teaching of Arithmetic, if a decimal coinage were adopted."

Fifthly—Sir J. Herschel, Master of the Royal Mint, says: "The adoption of the decimal system would reduce, immensely, the labour of scholars and teachers in schools, and would be of the greatest benefit in calculations generally."

Sixthly—Thomas Hankey, Esq., late Governor of the Bank of England, says: "The advantages of a change from our present system of coinage to a decimal system, would be very considerable; great saving of time and labour would be effected in calculations generally."

Seventhly—Henry Kirkham, Esq., Manager in an extensive mercantile establishment in Liverpool, adds: "That decimal coinage might be adopted without inconvenience or injury to the lower classes, and with great advantage to the community at large."

From what has been stated in the foregoing evidence, little doubt may be entertained as to the advantage that will accrue from a decimal system. As to the denominations of the coins, it is most probable that the florin, cent, and mil, will replace our shillings, pence, and farthings—a pound sterling standing as the integer; but no matter what denominations may be selected, all must agree, that every calculation will be based on the tenth, hundredth, and thousandth.

THE AUTHOR.

Manchester, Oct. 1855.

REDUCTION OF DECIMALS—FRACTIONS.*

PROBLEM 1.

To reduce fractions to decimals.

RULE.—Affix ciphers to the numerator, and divide by the denominator, the quotient will be the decimal. You must have as many decimal places in the answer as you annex ciphers.

EXAMPLES.

1.—Reduce $\frac{5}{8}$ to a decimal?

÷8) 5·000

·625 Ans.

2.—Reduce $\frac{13}{16}$ to a decimal?

÷16) 13·0000

·8125 Ans.

3.—Bring 1s. 6½d to the decimal of a pound?

1s.6½d. = $\frac{37}{480}$ ÷480) 37·00000

·77083 Ans.

4.—Reduce $\frac{7}{8}$ to a decimal?

÷8) 7·000

·875 Ans.

5.—Bring 3d. to the decimal of 1s.?

$\frac{3}{12}$ ÷12) 3·00

·25s. Ans.

6.—Bring 13s. 4$\frac{3}{4}$d. to the decimal of a pound?

$\frac{643}{960}$ ÷960) 643·000000

·669797 Ans.

ADDITION.

RULE.—Set down units under units, tens under tens, and in integers, separating with a decimal point, so that tenths may fall under tenths, hundreds under hundreds, &c. Add them up as whole numbers, keeping the decimal points under each other: the sum must have as many decimals as the numbers to be added.

---

* *Decimals Mean Tenths, &c.*—In calculating from left to right, the value of each figure is ten times less than the preceding one; ·2 is $\frac{2}{10}$, ·02 is $\frac{2}{100}$, .0003 is $\frac{3}{10000}$; ·47 reads, four tenths seven hundred parts; ·375 reads, three tenths, seven hundred, five thousand parts, &c.

Decimals increase their value from right to left, and decrease from left to right; they may be annexed to whole numbers, and added, subtracted, or divided the same way. If you annex ciphers to the right of decimals, it will not alter their value; ·2 or $\frac{2}{10}$, ·30 or $\frac{3}{100}$, ·400 or $\frac{4}{1000}$.

EXAMPLES.

1.—What is the sum of 127·35; 34·56; 83·176; 341·284; 13·341?

	127·35
	34·56
	83·176
	341·284
	13.341
Ans.	599·701

2.—What is the sum of 37·568; 9·367; 428·0076; 34·51; 110·33; 91·576?

	37·568
	9·367
	428·0076
	34·51
	110·33
	91·576
Ans.	711·3586

SUBSTRACTION.

RULE.—Write your numbers with the decimal points as in addition; subtract as in whole numbers; point off as many figures for decimals in the remainder as there are in either of the numbers to be subtracted.

EXAMPLES.

1.—Subtract 67·34 from 104·532?

From	104·532
Take	67·34
Ans.	37·192

2.—From 13·408 take 9·2993?

	13·348
	9·2993
Ans.	4·0487

NOTE.—In repeating decimals, set them down as before, but borrow from 9 instead of 10.

MULTIPLICATION.

RULE.—Multiply as in whole numbers; point off as many figures for decimals as there are in multiplicand and multiplier.

EXAMPLES.

1.—Multiply 2·734 by 4·35

	·13670
	8202
	10·936
Ans.	11·89290

2.—Multiply ·125 by ·12

	* ·01500

* When you have not as many figures in the product as you should have decimals, add 0 as above.

DIVISION.

RULE.—Divide as in whole numbers; point off as many decimals in the quotient as the number in the dividend exceeds the number in the divisor; have the decimal figures in the divisor and quotient equal to that in the dividend.

EXAMPLES.

1.—Divide 173·54250 by 3·75 ?
÷3·75) ———
Quot. 46·278

2.—Divide 987·56384 by 5·87 ?
÷5·87) ———
Quot. 166·535

Observe.—You have five decimal places in the dividend, and two in the divisor, consequently, the difference is three decimal places, which is the number to be pointed off.

REDUCTION OF DECIMAL COINS.

TABLE.—10 mils, 1 cent: 10 cents, 1 florin; 10 florins, 1 pound sterling; 1000 mils = 100 cents; 100 cents = 10 florins; 10 florins = £1.

PROBLEM 2.

To bring farthings, pence, and shillings to mils, cents, and florins; a pound being the integer.

RULE.—For the farthings, divide 960 (the farthings in a pound) into 1000; the mils in a pound; for halfpence, 480; for pence, 240; multiplying the quotient in each case, by the number of farthings, halfpence, pence, &c., and you have the mils, cents, and florins.

EXAMPLES.

1.—In a farthing, how many mils ?
÷ 960) 1000 = 1m. and 1-24th. Ans.

2.—In a half-penny, haw many mils ?
÷ 480) 1000 = 2m. and 1-12th, Ans.

3.—In three farthings, how many mils ?
÷ 960) 1000 = 1 and 1-24th × 3 = 3m. 1-8th. Ans.

4.—In one penny, how many mils ?
÷ 240) 1000 = 4m. and 1-6th. Ans.

5.—Bring two pence to mils ?
÷ 240) 1000 = 4m. and 1-6th × 2 = 8m. and 1-3rd. Ans.

6.—Bring five pence to cents and mils ?
÷ 240) 1000 = 4m. and 1-6th × 5 = 2c. 0m. and 5-6ths. Ans.

7.—In seven pence, how many cents and mils?
÷ 240) 1000=4m. and 1-6th × 7=2c. 9m. and 1-6th. Ans.

8.—In eight pence, how many cents and mils?
÷ 240) 1000=4m. and 1-6th × 8=3c. 3m. and 1-3rd. Ans.

9.—How many cents and mils in eleven pence?
÷ 240) 1000=4m. and 1-6th × 11=4c. 5m. and 5-6th. Ans.

10.—How many cents and mils in twelve pence?
÷ 240) 1000=4m. and 1-6th × 12=5c. 0m. Ans.

11.—In one shilling and a penny, how many cents and mils?
÷ 240) 1000=4m. and 1-6th × 13=5c. 4m. and 1-6th. Ans.

12.—In one shilling and eight pence, how many cents and mils?
÷ 240) 1000=4m. and 1-6th × 20=8c. 3m. and 1-3rd. Ans.

13.—In two shillings and a penny, how many florins, cents, and mils?
÷ 240) 1000=4m. and 1-6th × 25=1f. 0c. 4m. Ans.

14.—In three shillings and ten pence, how many florins, cents, and mils?
÷ 240) 1000=4m. and 1-6th × 46=1f. 9c. 1m. and 2-3rds. Ans.

15.—In four shillings, how many florins, cents, and mils?
÷ 240) 1000=4m. and 1-6th × 48=2f. 0c. 0m. Ans.

16.—In five shillings, how many florins, cents, and mils?
÷ 240) 1000=4m. and 1-6th × 60=2f. 5c. 0m. Ans.

17.—In eight shillings, how many florins, cents, and mils?
÷ 240) 1000=4m. and 1-6th × 96=4f. 0c. 0m. Ans.

18.—In ten shillings, how many florins, cents, and mills?
÷ 240) 1000=4m. and 1-6th × 120=5f. 0c. 0m. Ans.

19.—In thirteen shillings and four pence, how many florins, cents, and mils?
÷ 240) 1000=4m. and 1-6th × 160=6f. 6c. 6m. and 2-3rds. Ans.

20.—In fifteen shillings, how many florins, cents, and mils?
÷ 240) 1000=4m. and 1-6th × 180=7f. 5c. 0m. Ans.

NOTE.—The residual number after the mils perfects the equivalent, and represents fractional parts, 24 of which make $\frac{1}{1000}$ of £1 or mil, (·001,) as will be seen in table, page 153. A sovereign=1000m.; half ditto, 500m.; a crown, 250m.; half ditto, 125m.; a florin, 100m.; a shilling, ·05c. 0m.; sixpence, ·02c. 5m.; fourpence, ·016m. and 16-24th.; one penny, ·004m. and 4-24th.; halfpenny=002m. and 2-24th.; and one farthing=001m. and 1-24th.

Enough has been said to show how farthings, pence, and shillings, may be reduced to mils, cents, and florins; and this is the first step in decimal currency recommended to those who wish to become acquainted with a change in the coins.

REVERSE OF THE FOREGOING.

PROBLEM 8.

To reduce mils, cents, and florins to pence, shillings, and pounds.

RULE.—Multiply 240, the pence in a pound, by the number of mils, cents, and florins: divide the product by 1000, and you have the answer in pence and shillings.

EXAMPLES.

1.—In four mils and one-sixth, how many pence?
240 × 4m. and 1-6th = 1000 ÷ 1000 = 1d. Ans.

2.—In six mils and one-fourth, how many pence?
240 × 6m. and 1-4th = 1500 ÷ 1000 = 1½d. Ans.

3.—In eight mils and one-third, how many pence?
240 × 8m. and 1-3rd = 2000 ÷ 1000 = 2d. Ans.

4.—How many pence in nine mils and three-eights?
240 × 9m. and 3-8th = 2250 ÷ 1000 = 2¼d. Ans.

5.—How many pence in one cent, two mils, and 1-2nd?
240 × 1c. 2m. and 1-2nd = 3000 ÷ 1000 = 3d. Ans.

6.—In three cents, seven mils, and 1-2nd, how many pence?
240 × 3c. 7m. and 1-2nd = 9000 ÷ 1000 = 9d. Ans.

7.—In four cents, five mils, and five-sixths, how many pence?
240 × 4c. 5m. and 5-6th = 11,000 ÷ 1000 = 11d. Ans.

8.—How many pence in five cents?
240 × 5f. 0c. = 12,000 ÷ 1000 = 12d. Ans.

9.—In six cents, six mils, and two-thirds, how many shillings and pence?
240 × 6c. 6m. and 2-3ds = 16,000 ÷ 1000 = 16d., or 1s. 4d. Ans.

10.—In one florin, two cents, nine mils, and one-sixth, how many shillings?
240 × 1f. 2c. 9m. and 1-6th = 31,000 ÷ 1000 = 31d., or 2s. 7d. Ans.

11.—In two florins, how many shillings?
240 × 2f. 0c. 0m. = 48,000 ÷ 1000 = 48d., or 4s. Ans.

12.—In two florins and five cents, how many shillings?
240 × 2f. 5c. 0m. = 60,000 ÷ 1000 = 60d., or 5s. Ans.

13.—In three florins, nine cents, one mil, and two-thirds, how many pence?
240 × 3f. 9c. 1m. and 2-3rds = 94,000 ÷ 1000 = 94d., or 7s. 10d.

14.—In five florins, how many shillings?
240 × 5f. 0c. 0m. = 120,000 ÷ 1000 = 120d., or 10s. Ans.

15.—In eight florins, how many shillings?
240 × 8f. 0c. 0m. = 192,000 ÷ 1000 = 192d., or 16s. Ans.

16.—In eight florins and five cents, how many shillings?
240 × 8f. 5c. 0m. = 204,000 ÷ 1000 = 204d., or 17s. Ans.

17.—In nine florins, how many shillings?
240 × 9f. 0c. 0m. = 216,000 ÷ 1000 = 216d., or 18s. Ans.

18.—In nine florins, two cents, and five mils, how many shillings?
240 × 9f. 2c. 5m. = 222,000 ÷ 1000 = 222d., or 18s. 6d. Ans.

19.—In nine florins and five cents, how many shillings?
240 × 9f. 5c. 0m. = 228,000 ÷ 1000 = 228d., or 19s. Ans.

20.—In nine florins, seven cents, and five mils, how many shillings?
240 × 9f. 7c. 5m. = 234,000 ÷ 1000 = 234,000d., or 19s. 6d. Ans.

21.—In one thousand cents, how many shillings?
240 × 1000c. = 240,000 ÷ 1000 = 240d. ÷ 12 = 20s., or £1. Ans.

MERCANTILE CALCULATIONS BY DECIMALS; THE SAME CHANGED INTO THE PRESENT CURRENCY.

PROBLEM 4.

To calculate any number of yards, tons, cwts., qrs., lbs., &c., at any number of mils, cents, and florins per yard, per ton, per qr., per lb., &c.

RULE.—Multiply mils, cents, and florins by the quantity you want to calculate for, and you have the answer in florins, cents, and mils. If you require the same in the present currency, multiply 240 by the number of florins, cents, and mils so found; divide the product by 1000, and you have the answer in pounds, shillings, and pence.

EXAMPLES.

1.—What will ten yards of calico come to, at eight mils and one-third per yard?

8 1-3rd.
10

8c. 3m. 1-3rd. Ans. in decimals.

240
83 1-3rd.

720
1920
80

÷1000) 20,000

20d., or 1s. 8d. Ans. in present currency.

2.—What will twenty-five yards of linen come to, at nine cents and three mils per yard?

9c. 3m. × 25 = 23f. 2c. 5m. Ans. in decimals.

2325 × 240 = 558,000

÷1000)

558d.

£2 6s. 6d. Ans. in present currency.

3.—What will thirty-seven pounds of tea come to, at two florins, three cents, and seven mils per lb.?

2f. 3c. 7m. × 37 = 87f. 6c. 9m. Ans. in decimals.

8769 × 240 = 2104·560

÷1000)

2104½d.

£8 15s. 4½d. Ans. in present currency.

4.—What is the amount of fifty yards of silk, at two florins, three cents, and nine mils per yard, in decimals; also in the present coins?

2f. 3c. 9m. × 50 = 11950f. 5c. 0m. Ans. in decimals.

11950 × 240 = 2868000

÷1000)

2868d.

£11 19s. 0d. Ans. in present currency.

5.—What is the amount of ninety-nine gallons of brandy, at nine florins, three cents, and seven mils per gallon; the same in present currency?

9f. 3c. 7m. × 99 = 932f. 6c. 3m. Ans. in decimals.

93263 × 240 = 22383120

÷1000)

22383 $\frac{3}{8}$d.

£93 5s. 3 $\frac{3}{8}$d. Ans. in present currency.

6.—What will the carriage of eighty tons of goods from London to Manchester come to, at nine florins, three cents, and six mils per ton; the same in present currency?

9f. 3c. 6m. × 80 = 748f. 8c. 0m. Ans. in decimals.

74880 × 240 = 17971200

÷1000)

1797½d.

£74 17s. 7½d. Ans. in present currency.

7.—What will three hundred and seventy-four lbs. of spun silk come to, at seven florins, five cents, and three mils per lb.? The amount in decimals and present money is required.

7f. 5c. 3m. × 374 = 2816f. 2c. 2m. Ans. in decimals.

281622 × 240 = 67589290
+1000)

67589 $\frac{4}{5}$d.

£281 12s. 5 $\frac{4}{5}$d. Ans. in present currency.

8.—What is the amount of seven hundred and forty-five feet of mahogany, at one florin, three cents, and five mils per foot; the same reduced to present currency?

1f. 3c. 5m. × 745 = 1017f. 9c. 0m. Ans. in decimals.

101790 × 240 = 24429600
+1000)

24429 $\frac{3}{5}$d.

£101 15s. 9 $\frac{3}{5}$d. Ans. in present currency.

9.—What will two hundred and twelve yards of French cambric come to, at seven florins, five cents, and eight mils per yard, in decimal and present currency?

7f. 5c. 8m. × 212 = 1606f. 9c. 6m. Ans. in decimals.

160696 × 240 = 38567040
÷ 1000)

39567 $\frac{1}{5}$d.

£160 13s. 11 $\frac{1}{5}$d. Ans. in present currency.

10.—What will two thousand, three hundred and nineteen pounds of cast steel come to, at two cents and nine mils per pound; the same in present money?

2319 × 29 = 672f. 5c. 1m. Ans. in decimals.

67251 × 240 = 16140240
÷ 1000)

16140 $\frac{6}{5}$d.

£267 5s. 0 $\frac{6}{5}$d. Ans. in present currency.

11.—What will seven hundred and twenty-one cwt. of iron come to, at eight florins, nine cents, and nine mils per cwt.; the same in decimal money?

8f. 9c. 9m. × 721 = 6481f. 7c. 9m. Ans. in decimals.

648179 × 240 = 155562960
÷ 1000) ———
155562$\frac{3}{4}$d.

£648 3s. 6$\frac{3}{4}$d. Ans. in present money.

12.—What will one thousand, four hundred and seventy-six tons of coal come to, at five florins, three cents, and seven mils per ton; the amount required in both currencies?

1476 × 537 = 7926f. 1c. 2m. Ans. in decimals.

792612 × 240 = 190226880
÷ 1000) ———
190226$\frac{3}{4}$d.

£792 12s. 2$\frac{3}{4}$d. Ans. in present currency.

MONEYERS' WEIGHT TABLE.

24 Blanks	... make ...	1 Periot.	24 Droits	... ...	1 Mite.
20 Periots	... ...	1 Droit.	20 Mites	... ...	1 Grain.

RULE.—Grains × by 20 are mites; mites × by 24 are droits; droits × by 20 are periots; and periots × by 24 are blanks. Blanks ÷ by 24 are periots; periots ÷ by 20 are droits; droits ÷ by 24 are mites; and mites ÷ by 20 are grains.

The following Tables, showing the decimal equivalent in 1,000th of £1, (mil,) from $\frac{1}{4}$d. to £1., are based on Franklin's system.—*Vide* Evidence before a Committee of the House of Commons, page 141:—

SHOWING THE DECIMAL EQUIVALENT IN 1,000TH OF £1, (MIL,) FROM ¼D. TO £1; ALSO THE CONVERSE AT SIGHT.

Present Currency.	Decimal of £1 or Mil.	24 Parts = 1 Mil.	Present Currency.	Decimal of £1 or Mil.	Present Currency.	Decimal of £1 or Mil.
D.	F. C. M.		S. D.	F. C. M.	S. D.	F. C. M.
¼	·0 0 1	1–24	1 1	·0 5 4	5 1	·2 5 4
½	·0 0 2	1–12	1 2	·0 5 8	5 2	·2 5 8
¾	·0 0 3	1–8	1 3	·0 6 2	5 3	·2 6 2
1	·0 0 4	1–6	1 4	·0 6 6	5 4	·2 6 7
1¼	·0 0 5	5–24	1 5	·0 7 0	5 5	·2 7 1
1½	·0 0 6	1–4	1 6	·0 7 5	5 6	·2 7 5
1¾	·0 0 7	7–24	1 7	·0 7 9	5 7	·2 7 9
2	·0 0 8	1–3	1 8	·0 8 3	5 8	·2 8 3
2¼	·0 0 9	3–8	1 9	·0 8 7	5 9	·2 8 7
2½	·0 1 0	5–12	1 10	·0 9 1	5 10	·2 9 2
2¾	·0 1 1	11–24	1 11	·0 9 5	5 11	·2 9 6
3	·0 1 2	1–2	2 0	·1 0 0	6 0	·3 0 0
3¼	·0 1 3	13–24	2 1	·1 0 4	6 1	·3 0 4
3½	·0 1 4	7–12	2 2	·1 0 8	6 2	·3 0 8
3¾	·0 1 5	5–8	2 3	·1 1 2	6 3	·3 1 2
4	·0 1 6	2–3	2 4	·1 1 6	6 4	·3 1 7
4¼	·0 1 7	17–24	2 5	·1 2 0	6 5	·3 2 1
4½	·0 1 8	3–4	2 6	·1 2 5	6 6	·3 2 5
4¾	·0 1 9	19–24	2 7	·1 2 9	6 7	·3 2 9
5	·0 2 0	5–6	2 8	·1 3 3	6 8	·3 3 3
5¼	·0 2 1	7–8	2 9	·1 3 7	6 9	·3 3 7
5½	·0 2 2	11–12	2 10	·1 4 1	6 10	·3 4 2
5¾	·0 2 3	23–24	2 11	·1 4 5	6 11	·3 4 6
6	·0 2 5	.....	3 0	·1 5 0	7 0	·3 5 0
6¼	·0 2 6	1–24	3 1	·1 5 4	7 1	·3 5 4
6½	·0 2 7	1–12	3 2	·1 5 8	7 2	·3 5 8
6¾	·0 2 8	1–8	3 3	·1 6 2	7 3	·3 6 2
7	·0 2 9	1–6	3 4	·1 6 6	7 4	·3 6 7
7¼	·0 3 0	5–24	3 5	·1 7 0	7 5	·3 7 1
7½	·0 3 1	1–4	3 6	·1 7 5	7 6	·3 7 5
7¾	·0 3 2	7–24	3 7	·1 7 9	7 7	·3 7 9
8	·0 3 3	1–3	3 8	·1 8 3	7 8	·3 8 3
8¼	·0 3 4	3–8	3 9	·1 8 7	7 9	·3 8 7
8½	·0 3 5	5–12	3 10	·1 9 1	7 10	·3 9 2
8¾	·0 3 6	11–24	3 11	·1 9 5	7 11	·3 9 6
9	·0 3 7	1–2	4 0	·2 0 0	8 0	·4 0 0
9¼	·0 3 8	13–24	4 1	·2 0 4	8 1	·4 0 4
9½	·0 3 9	7–12	4 2	·2 0 8	8 2	·4 0 8
9¾	·0 4 0	5–8	4 3	·2 1 2	8 3	·4 1 2
10	·0 4 1	2–3	4 4	·2 1 6	8 4	·4 1 7
10¼	·0 4 2	17–24	4 5	·2 2 0	8 5	·4 2 1
10½	·0 4 3	3–4	4 6	·2 2 5	8 6	·4 2 5
10¾	·0 4 4	19–24	4 7	·2 2 9	8 7	·4 2 9
11	·0 4 5	5–6	4 8	·2 3 3	8 8	·4 3 3
11¼	·0 4 6	7–8	4 9	·2 3 7	8 9	·4 3 7
11½	·0 4 7	11–12	4 10	·2 4 1	8 10	·4 4 2
11¾	·0 4 8	23–24	4 11	·2 4 5	8 11	·4 4 6
12	·0 5 0	.....	5 0	·2 5 0	9 0	·4 5 0

SHOWING THE DECIMAL EQUIVALENT IN 1,000TH OF £1, (MIL,) FROM ½D. TO £1; ALSO THE CONVERSE AT SIGHT.

Present Currency.	Decimal of £1 or Mil.	Present Currency.	Decimal of £1 or Mil.	Present Currency.	Decimal of £1 or Mil.	24 Parts =1 Mil.
S. D.	F. C. M.	S D.	F. C. M.	S. D.	F. C. M.	
9 1	·4 5 4	13 1	·6 5 4	17 1	·8 5 4	4
9 2	·4 5 8	13 2	·6 5 8	17 2	·8 5 8	8
9 3	·4 6 2	13 3	·6 6 2	17 3	·8 6 2	12
9 4	·4 6 7	13 4	·6 6 7	17 4	·8 6 8	16
9 5	·4 7 1	13 5	·6 7 1	17 5	·8 7 0	20
9 6	·4 7 5	13 6	·6 7 5	17 6	·8 7 5	0
9 7	·4 7 9	13 7	·6 7 9	17 7	·8 7 9	4
9 8	·4 8 3	13 8	·6 8 3	17 8	·8 8 3	8
9 9	·4 8 7	13 9	·6 8 7	17 9	·8 8 7	12
9 10	·4 9 2	13 10	·6 9 2	17 10	·8 9 1	16
9 11	·4 9 6	13 11	·6 9 6	17 11	·8 9 5	20
10 0	·5 0 0	14 0	·7 0 0	18 0	·9 0 0	0
10 1	·5 0 4	14 1	·7 0 4	18 1	·9 0 4	4
10 2	·5 0 8	14 2	·7 0 8	18 2	·9 0 8	8
10 3	·5 1 2	14 3	·7 1 2	18 3	·9 1 2	12
10 4	·5 1 7	14 4	·7 1 7	18 4	·9 1 6	16
10 5	·5 2 1	14 5	·7 2 1	18 5	·9 2 0	20
10 6	·5 2 5	14 6	·7 2 5	18 6	·9 2 5	0
10 7	·5 2 9	14 7	·7 2 9	18 7	·9 2 9	4
10 8	·5 3 3	14 8	·7 3 3	18 8	·9 3 3	8
10 9	·5 3 7	14 9	·7 3 7	18 9	·9 3 7	12
10 10	·5 4 2	14 10	·7 4 2	18 10	·9 4 1	16
10 11	·5 4 6	14 11	·7 4 6	18 11	·9 4 5	20
11 0	·5 5 0	15 0	·7 5 0	18 11½	·9 4 7	22
11 1	·5 5 4	15 1	·7 5 4	19 0	·9 5 0	0
11 2	·5 5 8	15 2	·7 5 8	19 0½	·9 5 2	2
11 3	·5 6 2	15 3	·7 6 2	19 1	·9 5 4	4
11 4	·5 6 7	15 4	·7 6 7	19 1½	·9 5 6	6
11 5	·5 7 1	15 5	·7 7 1	19 2	·9 5 8	8
11 6	·5 7 5	15 6	·7 7 5	19 2½	·9 6 0	10
11 7	·5 7 9	15 7	·7 7 9	19 3	·9 6 2	12
11 8	·5 8 3	15 8	·7 8 3	19 3½	·9 6 4	14
11 9	·5 8 7	15 9	·7 8 7	19 4	·9 6 6	16
11 10	·5 9 2	15 10	·7 9 2	19 4½	·9 6 8	18
11 11	·5 9 6	15 11	·7 9 6	19 5	·9 7 0	20
12 0	·6 0 0	16 0	·8 0 0	19 5½	·9 7 2	22
12 1	·6 0 4	16 1	·8 0 4	19 6	·9 7 5	0
12 2	·6 0 8	16 2	·8 0 8	19 6½	·9 7 7	2
12 3	·6 1 2	16 3	·8 1 2	19 7	·9 7 9	4
12 4	·6 1 7	16 4	·8 1 6	19 7½	·9 8 1	6
12 5	·6 2 1	16 5	·8 2 0	19 8	·9 8 3	8
12 6	·6 2 5	16 6	·8 2 5	19 8½	·9 8 5	10
12 7	·6 2 9	16 7	·8 2 9	19 9	·9 8 7	12
12 8	·6 3 3	16 8	·8 3 3	19 9½	·9 8 9	14
12 9	·6 3 7	16 9	·8 3 7	19 10	·9 9 1	16
12 10	·6 4 2	16 10	·8 4 1	19 10½	·9 9 3	18
12 11	·6 4 6	16 11	·8 4 5	19 11	·9 9 5	20
13 0	·6 5 0	17 0	·8 5 0	20 0	·1·0 0 0	0

USE OF DECIMALS BY LOGARITHMS.

The following Tables have been written with a view to enable the Arithmetician to avail himself of the valuable aid of Logarithms. Their use will assist to remove all obstacles in the absence of decimal coins, &c.

To form an idea of the nature of Logarithms, we must call to mind that in every multiplication by a whole number, the proportion of the product to the multiplicand is the same as the proportion of the multiplier to unity; it then follows that the proportion of the product to unity must be equal to the sum of the two proportions of the multiplier to unity, and of the multiplicand to unity, since it is compounded of the proportions of itself to the multiplicand, and of the multiplicand to unity. Any artificial numbers therefore, which represents the proportions of all sorts of numbers to unity, will be the addition of those two that represent the proportions of any multiplier and multiplicand to unity, and give an artificial number representing the proportion of the product to unity, consequently, the natural number to which it would correspond in the table would be the product of the multiplicand and multiplier.

A series of numbers in Arithmetical progression, corresponding to as many others in Geometrical progression: so that 0 in the Arithmeticals corresponds to 1 in the Geometricals, and supplies the artificial numbers we require:—

0 1 2 3 4 5 6 Arithmetical progression, or Logarithms.
1 2 4 8 16 32 64 Geometrical progression, or natural numbers.
1 10 100 1000 10,000 100,000 1000,000

EXAMPLES.

1.—To multiply 8 by 4?

Log. of 8=3
Log. of 4=2

Log. of 32=5 Sum.

2.—To multiply 1000 by 100?

Log. of 1000=3
Log. of 100=2

Log. of 100,000=5 Sum.

Division is performed by the subtraction of the Logarithm of the divisor from the Logarithm of the dividend, the remainder is the Logarithm of the quotient.

EXAMPLE.

3.—Divide 64 by 8?

Log. of 64=6
Log. of 8=3

Log. of 8=3

By ranging the second term 2 or 10 of the Geometrical progression, it is apparent that we may have an endless variety of Logarithms to the same natural numbers: for it is evident, that whatever number represents the ratio or proportion of 10 to 1, the ratio of 100 to 1, and of 1000 to 1, can only be represented by twice or three times that number, since their proportions to 1 are double and triple the ratio of 10 to 1.

NEW DECIMAL TABLES,

Showing the Value of Decimals in Money, Weights, Time, and Measures.

TABLE I.—OF MONEY.

A Shilling the Integer.			A Pound the Integer.			A Pound the Integer.	
D.	F.	Decimal Parts.	D.	F.	Decimal Parts.	S.	Decimal Parts.
0	¼	s 0·020833	0	¼	s0·0010416	1	£0·05
0	½	·041666	0	½	·002083	2	·1
0	¾	·0625	0	¾	·003125	3	·15
1	0	·083333	1	0	·004166	4	·2
1	¼	·104166	1	¼	·0052	5	·25
1	½	·125	1	½	·00625	6	·3
1	¾	·145833	1	¾	·00729	7	·35
2	0	·166666	2	0	·00833	8	·4
2	¼	·1875	2	¼	·009375	9	·45
2	½	·208333	2	½	·010416	10	·5
2	¾	·227166	2	¾	·0114583	11	·55
3	0	·25	3	0	·0125	12	·6
3	¼	·270833	3	¼	·0135416	13	·65
3	½	·291666	3	½	·014583	14	·7
3	¾	·3125	3	¾	·015625	15	·75
4	0	·333333	4	0	·016666	16	·8
4	¼	·354166	4	¼	·0177083	17	·85
4	½	·375	4	½	·01875	18	·9
4	¾	·395833	4	¾	·0197916	19	·95
5	0	·416666	5	0	·02083	20	£1·00
5	¼	·4375	5	¼	·021875		
5	½	·458333	5	½	·022916		
5	¾	·479166	5	¾	·0239583		
6	0	·5	6	0	·025		
6	¼	·520833	6	¼	·0260416		
6	½	·541666	6	½	·0270083		
6	¾	·5625	6	¾	·028125		
7	0	·583333	7	0	·029166		
7	¼	·604166	7	¼	·0302083		
7	½	·625	7	½	·03125		
7	¾	·645833	7	¾	·0322916		
8	0	·666666	8	0	·033333		
8	¼	·6875	8	¼	·034375		
8	½	·708333	8	½	·035416		
8	¾	·729166	8	¾	·0364583		
9	0	·75	9	0	·0375		
9	¼	·770833	9	¼	·0385416		
9	½	·791666	9	½	·039583		
9	¾	·8125	9	¾	·040625		
10	0	·833333	10	0	·041666		
10	¼	·854166	10	¼	·0427083		
10	½	·875	10	½	·04375		
10	¾	·895833	10	¾	·0447916		
11	0	·916666	11	0	·045833		
11	¼	·9375	11	¼	·046875		
11	½	·958333	11	½	·047916		
11	¾	s ·979166	11	¾	s ·0489583		
12	0	1·000000	12	0	1·000000		

NOTE.—By these and the following Tables, all the species of Money, Weight, Time, and Measure, are turned into decimal parts, and results obtained with the greatest facility, whatever may be the integer.

As to the use and application of the Tables, they are so very clear and intelligible, as to require little explanation. Their familiarity to the student will soon make him acquainted with the many advantages to be derived from the system of Decimal Arithmetic.

TABLE II.—TROY WEIGHT.

A lb the Integer.	Decimal Parts of 1 lb. Troy.
1 grain	lb. 0·0001736
2 „	·0003472
3 „	·0005208
4 g., or 1 carat.	·0006944
2 carats	·0013889
3 „	·0020833
4 „	·0027778
5 „	·0034722
6 c., or 1 dwt....	·0041667
2 dwts.	·0083333
3 „	·0125000
4 „	·0166667
5 „	·0208333
6 „	·0250000
7 „	·0291667
8 „	·0333333
9 „	·0375000
10 „	·0416667
11 „	·0458333
12 „	·0500000
13 „	·0541667
14 „	·0583333
15 „	·0625000
16 „	·0666667
17 „	·0708333
18 „	·0750000
19 „	·0791667
20 dwts. or 1 oz..	·0833333
2 oz.	·1666667
3 „	·2500000
4 „	·3333333
5 „	·4166667
6 „	·5000000
7 „	·5833333
8 „	·6666667
9 „	·7500000
10 „	·8333333
11 „	·9166667
12 „	lb. 1·000000

TABLE III.—AVOIRDUPOIS.

A lb the Integer.	Decimal Parts.
1 drachm ...	lb. 0·0039063
2 „	·0078125
3 „	·0117188
4 „	·0156250
5 „	·0195313
6 „	·0234375
7 „	·0273438
8 „	·0312500
9 „	·0351563
10 „	·0390625
11 „	·0429688
12 „	·0468750
13 „	·0507813
14 „	·0546875
15 „	·0585938
16 d., or 1 oz. ...	·0625000
2 oz.	·1250000
3 „	·1875000
4 „	·2500000
5 „	·3125000
6 „	·3750000
7 „	·4375000
8 „	·5000000
9 „	·5625000
10 „	·6250000
11 „	·6875000
12 „	·7500000
13 „	·8125000
14 „	·8750000
15 „	·9375000
16 oz., or 1 lb....	lb. 1·000000

NOTE.—Table III. in Avoirdupois Weight is used in large quantities, and Table IV. is constructed for small ones.

TABLE IV.—AVOIRDUPOIS.

A cwt. the Integer.	Decimal Parts of 1 cwt.
	cwt.
1 drachm ...	0·0000349
2 „	·0000698
3 „	·0001046
4 „	·0001395
5 „	·0001744
6 „	·0002093
7 „	·0002441
8 „	·0002790
9 „	·0003139
10 „	·0003488
11 „	·0003837
12 „	·0004185
13 „	·0004534
14 „	·0004883
15 „	·0005232
16 d., or 1 oz. ...	·0005580
2 oz.	·0011161
3 „	·0016741
4 „	·0022321
5 „	·0027902
6 „	·0033482
7 „	·0039063
8 „	·0044643
9 „	·0050223
10 „	·0055804
11 „	·0061384
12 „	·0066964
13 „	·0072545
14 „	·0078125
15 „	·0083705
16 oz., or 1 lb. ...	·0089286
2 lbs.	·0178571
3 „	·0267857
4 „	·0357143
5 „	·0446429
6 „	·0535714
7 „	·0625000
8 „	·0714286
9 „	·0803571
10 „	·0892857
11 „	·0982143
12 „	·1071429
13 „	·1160714
14 lbs., or 1 st....	·1250000
1 qr.	·2500000
2 qrs.	·500000
3 „	cwt. ·7500000
4 „	1·000000

TABLE V.—CHEMISTS' WEIGHT.

A lb the Integer.	Decimal Parts.
1 grain	lb. 0·0001736
2 „	·0003472
3 „	·0005208
4 „	·0006944
5 „	·0008681
6 „	·0010417
7 „	·0012153
8 „	·0013809
9 „	·0015625
10 „	·0017361
11 „	·0019097
12 „	·0020833
13 „	·0022569
14 „	·0024306
15 „	·0026042
16 „	·0027778
17 „	·0029514
18 „	·0031250
19 „	·0032986
20 gr., or 1 scr....	·0034722
2 scruples ...	·0069444
3 ditto, or 1 dr.	·0104167
2 drachms ...	·0208333
3 „	·0312500
4 „	·0416667
5 „	·0520833
6 „	·0625000
7 „	·0729167
8 drs., or 1 oz....	·0833333
2 oz.	·1666667
3 „	·2500000
4 „	·3333333
5 „	·4166667
6 „	·5000000
7 „	·5833333
8 „	·6666667
9 „	·7500000
10 „	·8333333
11 „	·9166667
12 „	lb. 1·0000000

TABLE VI.—LONG MEASURE.

A Mile the Integer.	Decimal Parts.
1 barleycorn ...	M. 0·0000053
2 ditto	·0000105
3 b.c., or inch ...	·0000158
2 inches	·0000316
3 ditto	·0000473
4 in., or 1 hand.	·0000631
5 inches	·0000789
6 ditto	·0000947
7 ditto	·0001105
8 ditto	·0001263
9 ditto	·0001421
10 ditto	·0001578
11 ditto	·0001736
12 in., or 1 foot.	·0001894
2 feet	·0003788
3 ft., or 1 yard.	·0005682
2 yards	·0011364
3 ditto	·0017046
4 ditto	·0022727
5 ditto ... }	·0028409
1 pole ... }	·0031250
2 poles	·0062500
3 ditto	·0093750
4 poles, or 1 land chain }	·0125000
2 chains	·0250000
3 ditto	·0375000
4 ditto	·0500000
5 ditto	·0625000
6 ditto	·0750000
7 ditto	·0875000
8 ditto	·1000000
9 ditto	·1125000
10 do., or 1 furlg.	·1250000
2 furlongs ...	·2500000
3 ditto	·3750000
4 ditto	·5000000
5 ditto	·6200000
6 ditto	·7500000
7 ditto	·8750000
8 do., or 1 mile.	M. 1·000000

TABLE VII.—CLOTH MEASURE.

A Yard the Integer.	Decimal Parts.
¼ inch	yd.0·0069444
½ ditto	·0138889
¾ ditto	·0208333
1 ditto	·0277778
2 ditto	·0555555
1 nail	·0625000
2 ditto	·1250000
3 ditto	·1875000
4 do., or 1 qr....	·2500000
2 quarters ...	·5000000
3 ditto	·7500000
4 do., or 1 yard.	yd.1·0000000

TABLE VIII.

Ale, Beer, Spirit, and Wine Measure.

A Gallon the Integer.	Decimal Parts.
1 gill	gal.0·0312500
2 ditto	·0625000
3 ditto	·0937500
4 g., or 1 pint.	·1250000
2 p., or 1 qrt....	·2500000
2 quarts	·5000000
3 ditto	·7500000
4 do., or 1 gal.	gal.1·0000000

TABLE IX.—DRY MEASURE.

A Quarter the Integer.	Decimal Parts.
1 pint	qrs.0·0019531
2 p., or 1 quart.	·0039063
2 q., or 1 pottle	·0078125
2 p., or 1 gal. ...	·0156250
2 gal., or 1 peck	·0312500
2 pecks	·0625000
3 ditto	·0937500
4 do., or 1 bshl.	·1250000
2 bushels ...	·2500000
3 ditto	·3750000
4 ditto	·5000000
5 ditto	·6250000
6 ditto	·7500000
7 ditto	·8750000
8 do., or 1 qr...	qrs.1·0000000

TABLE X.—OF TIME.

A Day the Integer.	Decimal Parts.	A Day the Integer.	Decimal Parts.
1 minute ...	day.0·0006944	51 minutes ...	day.0·0354167
2	·0013889	52	·0361111
3	·0020833	53	·0368056
4	·0027778	54	·0375000
5	·0034722	55	·0381944
6	·0041667	56	·0388889
7	·0048611	57	·0395833
8	·0055556	58	·0402778
9	·0062500	59	·0409722
10	·0069444	60 m., or 1 hour .	·0416667
11	·0076389	2 hours	·0833333
12	·0083333	3	·1250000
13	·0090278	4	·1666667
14	·0007222	5	·2083333
15	·0104167	6	·2500000
16	·0111111	7	·2916667
17	·0118056		
18	·0125000	9	·3333333
19	·0131944	10	·3750000
20	·0138889	11	·4166667
21	·0145833	12	·5000000
22	·0152778	13	·5416667
23	·0159722	14	·5833333
24	·0166667	15	·6250000
25	·0173611	16	·6666667
26	·0180556	17	·7083333
27	·0187500	18	·7500000
28	·0194444	19	·7916667
29	·0201389	20	·8333333
30	·0208333	21	·8750000
31	·0215278	22	·9166667
32	·0222222	23	·9583333
33	·0229167	24	day.1·0000000
34	·0236111		
35	·0243056		
36	·0250000	A Year the Integer.	Decimal Parts.
37	·0256944		
38	·0263889		
39	·0270833	1 month	y. 0·076923
40	·0277778	2	·153846
41	·0284722	3	·230769
42	·0291667	4	·307692
43	·0298661	5	·384615
44	·0305556	6	·461538
45	·0312500	7	·538461
46	·0319444	8	·615384
47	·0326389	9	·692307
48	·0333333	10	·76923
49	·0347222	11	·84615
50	·0347222	12	·92307

THE USE OF THE FOREGOING TABLES.

To convert a compound into a decimal quantity.

RULE.—Write down on the left of the decimal point the number that is of the same denomination as the integer in the table, and take from the table the decimal parts corresponding to the other denominations, and you will have the decimal required.

EXAMPLES.

1.—What decimal of the pound sterling is 9s. 11¾d.?

9s. =	£0·45
11d. =	0·045833
¾d. =	0·003125
	£0·498955 Ans.

2.—Write decimally 1 yard 2 qrs. 2 nails?

	yd. 1
	2 qrs. 0·5
	2 nls. 0·125
	yd. 1·625 Ans.

NOTE.—When the table does not, on account of the next denomination, contain the number of the preceding one, for which a corresponding decimal may be required, it may be conveniently found by adding together the decimals of two quantities of the same denomination, that make the required quantity.

EXAMPLE.

3.—What decimal of the cwt. is 19 lb.?

lbs.	cwt.
14 =	0·125
5 =	0·0446429
19 =	0·1696429 Ans.

To reduce any decimal into the equivalent in parts of money, weights, measures, &c., &c.

RULE.—Multiply the given decimal by the number of units contained in the next lower denomination of that species of quantity of which your decimal is; proceed till you come to the lowest part, and the several parts will be the quantity required.

EXAMPLES.

4.—What parts of a pound sterling are contained in 0·73825?

0.73825 × 20 = s.14·76500 × 12 = d.9·18000 × 4 = far. 0·72000 Ans. 14s. 9d. $\frac{72}{100}$

5.—Reduce ·49723 into the parts of a cwt.?

·49723 × 4 = qr.1·98892 × 28 = lb.27·68976 × 16 = oz.11·03616 × 16 = drs.0·57856.

Ans. 1 qr. 27 lb. 11 oz. 0½ dr.

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